THE

FRANKLIN JOURNAL,

AND

AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

FEBRUARY, 1828.

FRANKLIN INSTITUTE.

Philadelphia, January 17th, 1828.

The Sixteenth Quarterly Meeting of the Franklin Institute, was held in the Hall, James Ronaldson, President, in the chair.

The report of the Board of Managers, and also, the report of the Treasurer, were read, and accepted.

On motion, Resolved, That the report of the Board of Managers be published in the Franklin Journal, and in the public papers.

Resolved, That the reading of the names of those members who have not paid their dues, be postponed until the next Quarterly Meeting.

Resolved, That the President be requested to present the thanks of the Institute to Mr. Samuel V. Merrick, Treasurer, for the very able manner in which he has performed the duties of that office.

The Tellers reported the following gentlemen, as duly elected officers of the Institute, for the ensuing year.

Officers for the year 1828.

President—James Ronaldson.
Vice-Presidents—Mathew Carey, Thomas Fletcher.
Corresponding Secretary—Isaac Hays.
Recording Secretary—Thomas P. Jones.
Treasurer—Samuel V. Merrick.

Managers.

John Harrison, Samuel J. Robbins,
Abraham Miller, Isaiah Lukens,

Adam Ramage,	William Strickland,
James M'Alpin,	Henry Horn,
Isaac B. Garrigues,	M. D. Lewis,
William S. Warder,	W. Rowland,
A. G. Ralston,	Jacob Souder,
Rufus Tyler,	Charles H. White,
John Struthers,	G. Emerson,
John O'Neil,	George Fox,
M. W. Baldwin,	W. Stevenson,
Joseph H. Schreiner,	Andrew Young.

The Sixteenth Quarterly (Fourth Annual) Report of the Board of Managers.

PHILADELPHIA, JANUARY 17, 1828.

The Board of Managers of the Franklin Institute of the State of Pennsylvania, respectfully offer to the general meeting, their Sixteenth Quarterly report; containing an exhibition of their proceedings during the three months with which the period of their services terminates.

In taking a retrospective view of what has been accomplished by the Institute, during the four years which it has existed, ample cause of felicitation presents itself to those who have laboured for its support. That errors have been committed, in the prosecution of plans which were altogether novel to us, will be readily conceded; but if, in some points, we have attained less than the founders of the Institution anticipated, we have, in others, far transcended the hopes of the most sanguine; and the Board believe, that a wise and prudent course, will insure to the Franklin Institute, one of the highest stations among the popular institutions of our country.

In previous reports the corrective measures which had been adopted respecting the admission of youths to the lectures, and the resolution to issue tickets for ladies, have been made known. The Board have now the satisfaction of stating that these plans have been carried into effect, and that the anticipated advantages have been fully attained. The youths attending, nearly one hundred in number, have conducted themselves in a very decorous manner, and have evinced a commendable anxiety for the attainment of knowledge. Tickets have been procured by between forty and fifty ladies, who, notwithstanding the general inclemency of the weather, have attended with the utmost regularity; and have, undoubtedly, largely contributed, by the influence of their presence, to the establishment of that perfect decorum which was so much to be desired.

The courses of lectures on Mechanics and Chemistry commenced at the usual period, have been fully attended, and are believed to be well adapted, both from the nature of the subjects chosen, and the mode of treating them, to furnish the skilful mechanic and manufacturer, with that scientific knowledge, which will enable him to at-

tain the highest degree of perfection in his art. No volunteer lectures have been delivered during the present season, nor has any proposition been hitherto made with that view.

Since the last Quarterly Meeting, the Board have received the resignation of the chair of Chemistry, by Professor Keating, who was one of the most active of the founders, and most zealous and efficient of the supporters, of the Institute. It was the ardent wish of the Board that he should retain the Professorship, whilst any prospect remained of his early return to the United States; but as his present engagements have removed the hope which had been entertained, his resignation was necessarily accepted. Whilst the Board regret the loss of those services which were felt in every department, they have reason to congratulate the Institute upon the provisional fulfilment of the duties of the Professorship, by a gentleman, eminently qualified by his talents, and his extensive knowledge in the science of Chemistry, to advance the important objects for which it was established.

Dr. Godman, who has heretofore filled the chair of Natural History, has, also, in consequence of his removal from the city, tendered his resignation, which has been accepted. This Professorship was not one of those which it was originally intended to establish, as the subject is but remotely connected with the practical objects, which were deemed, in the first instance, most important to be embraced; but the liberal propositions of the late incumbent, induced the Board to make the appointment; an act which was fully justified by the interest which the course of lectures excited, and which, by the scientific acquirements, and popular talents of the lecturer, was sustained throughout.

Peter A. Browne, Esq. who has fulfilled the arduous duties of Corresponding Secretary, ever since the formation of the Institute, has, in consequence of the state of his health, and the pressure of other avocations, declined a re-election to that office. The important and lasting benefits which have been secured to the Institute by the exertions of this gentleman, will not be forgotten, as they are enrolled amongst its archives. Another faithful servant of the Institute, Mr. Hervey Lewis, has also been compelled to withdraw from the Board, on account of indisposition; his colleagues feel the loss of the aid of so useful a coadjutor, and most sincerely regret that it has been produced by such a cause.

The Committee of Instruction not having made a report, respecting the High School, since the opening of the present session, the Board is unable to do more than to state that its operations are still continued, and, it is believed, with the anticipated advantages to the pupils. It has not yet been found possible to obtain apartments adapted to its use, out of the Hall of the Institute; this, however, it is designed to accomplish, as it is very desirable that the rooms should be appropriated to the reception and display of models, apparatus, minerals, and other articles; and likewise that they should be occupied by the library, and as reading rooms.

The Board, desirous of promoting every object calculated to dif-

fuse information among the operative classes, made a tender of such rooms as they had at their disposal, and of the use of the books belonging to the Institute, free of charge, to 'The Mechanics' Library Company of Philadelphia.' This offer, it is believed, they have not thought proper to accept; for although no final answer has been obtained, such a length of time has elapsed, since the last communication was received from them, as to warrant this conclusion.

The vacancy in the Drawing School, occasioned by the resignation of Mr. Haviland, was filled by the appointment of Mr. George Strickland, who, in conjunction with Mr. Hugh Bridport, has attended to the duties of that department, since the commencement of the session. The number of pupils in this school is less than formerly; and it is much to be regretted, that Mechanics, and others, do not more frequently avail themselves of the great facilities offered, in the smallness of the charge, and the talents of the teachers, for acquiring skill in an art so extensively useful.

Application has been made by the Philadelphia Sunday School Union, for the use of the Hall on the Sabbath day, for the moral and religious instruction of apprentices; and as this object is perfectly compatible, and indeed, in unison with those of the Institute, it has been determined to let it for that purpose, at a very moderate rent.

The Treasurer's account, which is herewith presented, exhibits a balance, in hand, of $16 $\frac{3}{100}$. It appears, also, that there is an outstanding balance, due from members, amounting to $874 $\frac{50}{100}$, and as it is probable that some considerable portion of this, may hereafter be collected, the Treasurer has recommended that the reading of the names of delinquents, be postponed until the next meeting of the Institute.

By the report of the Managers of the Sinking Fund, it appears, that the sum of $1319, has been appropriated to that object, during the last year.

Accepted by the Board,

THOMAS P. JONES, *Secretary.*

On Casting, Grinding, and Polishing Speculums, for Reflecting Telescopes, Microscopes, &c. By the Rev. JOHN EDWARDS, B. A.

[Continued from p. 46.]

As the manner of working or figuring the metal upon the first, and indeed upon all the succeeding tools, is taught in Dr. Smith's Optics, or the before mentioned volume of the Philosophical Transactions, I shall refer my reader to those publications, as I only mean to give my own improvements. When the metal is brought to a true figure, it must be taken to a convex tool, formed with some stones from a place called Edgedon, in Shropshire, situated between Ludlow and Bishop's Castle. These stones, or hones, are of a fine grain, and will

easily cut the metal, and bring it to a fine face. Indeed, the blue hones* used in general by the opticians for this purpose, will scarcely touch the metal, and it will be a laborious undertaking to bring the metal to a fine face, so as to take out all the breaks up from the emery, by the common blue hones. By means, however, of the above mentioned stones, they may be easily ground and truly figured. The bed of stones should be of a circular figure, and but very little larger than the metal intended to be figured upon it, viz. about two-tenths of an inch, but not more for a speculum of four or five inches in diameter. If the tool is made considerably larger than the metal, it will grind the metal perpetually into a larger sphere, and by no means of a good figure: if the metal and tool are of the same size exactly, the metal will work truly spherical; but it is apt to shorten its focus less and less, unless the metal and tool are worked alternately upwards. It had, therefore, better be made a littlet larger than the mirror, when it will not alter its focus. Too much water should not be used at a time upon the hone pavement, or the figure will be very bad, which may easily be seen by the face of the metal appearing of different degrees of brightness, in different parts of it. When the metal is brought to a very fine face and figure by the bed of stones, it is ready to receive a polish: but before I shall give any directions with regard to the manner of polishing it, I must mention a circumstance or two, I had inadvertently passed over. The metal must not be cast too thick, or it will never take the parabolic figure intended to be given to it. The best proportion I have found for this purpose, is that a metal of four inches and a half diameter, and eighteen inches focus, should be four-tenths of an inch thick at the edge of it: the back of the mirror should be convex, to strengthen it, and to cause it to spring, and adhere to the polisher, uniformly. Its convexity should be equal to its concavity on the face, that the metal may be every where of an equal thickness. The handle should be made of lead, of the same convexity and concavity as the metal, its thickness about double that of the metal, and its diameter three-fourths of that of the speculum; it should have a hole in the middle, with a copper or iron screw on it, so as to put it together, with the mirror, to which it is fastened with pitch, on a collar lathe, in order to smooth and finish the edge of the metal, which may be done by holding a fine file to it when in the lathe at the first, and afterwards one of the above mentioned stones.

Of polishing the Metal, and giving it the true parabolic Figure.

The rough grinder, of an *elliptical* form, is now to be covered with common pitch. I generally make my own pitch, by boiling tar in a ladle or crucible, over a very slow fire, till it becomes of the consistence I require; for a great nicety is required in the degree of the

* Should any one, however, make use of the common blue hones, he should use as little water as possible when the metal is put upon them, as they will cut much better when barely wet, than if much water is used upon their face.

† About one-twentieth part greater in diameter.

hardness of the pitch. The harder the pitch is, the better figure it will give to the metal, as it does not alter its figure in working as soft pitch does; besides, the metal will acquire a lustre upon a polisher moderately hard, so as to show objects reflected upon it, as vivid and as near their natural colour as possible; but if the pitch is too soft, some of its finest particles will always adhere to the face of the metal, and form a very fine and thin cuticle, or covering, upon its surface. This circumstance is rendered very evident, by viewing any white object in the metal, (a sheet of white paper for example,) when that fine cuticle or thin surface of the pitch upon the speculum, will cause it to show the object of a dingy brown colour, and not of its genuine whiteness. Pitch may be easily made harder by adding a proper quantity of rosin. I often use equal quantities of pitch and rosin, so as to make the mixture just so hard when cold, as to receive an impression from a moderate pressure of my nail. A polisher made with pitch and rosin has this advantage, viz. though it is hard, yet it is not so brittle as when pitch only is used, and made hard by boiling it, and consequently not so liable to break or chip off at the edges, and thereby scratch the metal. Pour the melted pitch and rosin, when pretty cool, from the crucible upon the elliptic tool,* so as to cover it every where, when spread upon it with an iron spatula, about the thickness of a half-crown piece. If the covering is too thin, it will continually alter its figure by the heat it acquires in working the metal upon it, and thereby give a bad figure also to the speculum. When it is somewhat cool, lay a piece of writing paper upon the surface of the pitch, press the face of the mirror upon it, and you will find the polisher will be nearly figured to the form of the speculum. If it has not taken an exact figure every where, which would appear by the fine marks of the grain of the paper upon the pitch, gently warm the surface of the pitch, and repeat the operation as before, until you have formed it of the exact† figure of the metal. With a penknife take away, now, all the superfluous pitch from the edge of the polisher, and with a conical piece of wood form the hole in the middle accurately round: in other words, let the pitchy surface be every where of the exact size, and shape, as the lead tool, which is under it. It may be necessary to mention, that the hole in the middle of the polisher should go quite through the tool, (for a particular reason,) and should be made of the same size, or somewhat less, than the hole in the middle of the speculum.

* The elliptic tool must be made pretty warm, or the pitch will not adhere to it.

† When the polisher is brought to its true figure, gently warm it at the fire, and with the edge of a knife, divide it into several squares, by pressing the edge of the knife gently upon the pitch; these squares, by receiving the small portion of the metal that works off it in polishing, will cause the figure of the speculum to be more correct, than if no such squares had been made. The polisher may also be formed without the writing paper, by dipping the mirror into cold water, and afterwards pressing it upon the surface of the pitch, (when it is somewhat cool,) and by repeating this operation till it has taken the exact figure of the metal.

This is a necessary caution, and indeed I have always found that small mirrors, without any hole in the middle, will polish much better, and the figure will be more correct, if the polisher has a hole in the middle. The powder I prefer above all others, to give a most exquisite lustre, is *colcothar of vitriol*, and not *putty*. *Putty* gives metals a white lustre, or as workmen call it, a silver hue; but good colcothar of vitriol will polish with a very fine and high black lustre, so as to give the metal finished with it, the complexion of polished steel. To know if the colcothar of vitriol is good, put some of it into your mouth, and if you find it dissolves away it is good; but if you find it hard, and crunch between your teeth, then it is bad, and not well burned. Good colcothar of vitriol is of a deep red, or a deep purple colour, and is soft and oily when rubbed between the fingers; bad colcothar of vitriol is of a light red colour, and feels harsh and gritty. The colcothar of vitriol should be levigated between two surfaces of polished steel, and wrought with a little water; when it is worked dry, you may add a little more water, to carry it lower down, to what degree you please. When the colcothar of vitriol has been wrought dry three or four times, it will acquire a black colour, and will be low enough, or sufficiently fine, to give an exquisite lustre. This levigated colcothar of vitriol I put in a small phial, and pour some water upon it, and afterwards I use it for polishing the metals, in the same manner that washed putty is always directed to be made use of for that purpose. I always put on a large quantity of washed colcothar of vitriol at once, so as to saturate the pitch, and form a fine coating of the colcothar, and very rarely make use of a second application. If a second or third application of colcothar should be found necessary to bring the metal to a high lustre, or to take out any scratches upon its face, use it very sparingly, or you will destroy the polish you have already attained. When the metal is nearly polished, it will always generate some black mud upon the surface of the mirror, and also upon the tool. Wipe it now away from the face of the metal with some very soft wash leather; though, if too much of this mud be taken away, it will not polish so well. Indeed, a little experience in these matters will better suffice, than a volume written upon the subject.

In regard to the *parabolic figure* to be given to the metal, no particular caution is required in the polishing; the *elliptical tool* will always cause the speculum to work into an accurate parabolical figure, supposing the transverse and conjugate diameters bear the true proportion to each other, and the metal is not too thick to prevent it always from adhering firmly and uniformly to the polisher. Should the pitch prove too soft, it will give way, and alter the figure a little. This circumstance will render the figure of the mirror sometimes a small degree short of the parabola, and sometimes a very little beyond it; but by a little perseverance the correct figure is very easily acquired. I could very easily give the reader the reason, why an *elliptical tool* of a proper proportion will always give a parabolical figure; and if the transverse diameter is increased, it will then always give an hyperbolical figure; but as I am writing upon

the practical part of making reflecting telescopes, and not the theory, I will not offend his patience. To convince any one of the certainty of my assertions, let him polish a metal of $2\frac{1}{2}$ inches diameter, and $9\frac{1}{4}$ inches focus, upon an *elliptical tool*, whose diameters are $2\frac{1}{2}$ and 3 inches; and I can assert, he will always find the metal, when polished, (if it is not too thick,) beyond the parabola, or it will always prove hyperbolical. If he polishes it upon a *circular* tool in the common way, with cross strokes in every direction possible, using first a few round strokes every time he changes his position, he will find it always prove spherical, and consequently *short* of the parabola. A very little experience in these matters, will convince any one of the ease and certainty of giving the great speculum a parabolic figure, by polishing it in a common manner only with cross strokes in every possible direction, upon an *elliptical tool* of the proper dimensions, in which, for common foci and apertures, viz. $2\frac{1}{2}$ to $9\frac{1}{2}$ focus, or 3,8 inches in diameter to 18 inches focus, the diameters should be 10 to 9. The shortest diameter of the ellipse being accurately the same as the diameter of the metal, and the longest diameter of the ellipse to the shortest diameter, as 10 to 9.

[TO BE CONTINUED.]

On the Colours obtained from the Metallic Oxides, and fixed by Fusion on different Vitreous Bodies; abstracted from an essay on that subject. By ALEXANDER BRONGNIART, *Director of the National Manufactory of Porcelain at Sevres, in France.*

THE art of employing metallic oxides for colouring by fusion different vitreous matters, is of very great antiquity: every body knows that the ancients manufactured coloured glass and enamel, and that this art was practised in particular by the Egyptians, the first people who in this manner imitated precious stones.

The practice of this art in modern times has been carried to a high degree of perfection: but the theory has been neglected; it is almost the only one of the chemical arts in which no attempt has yet been made to apply the new principles of that science.

The very numerous works which treat on the method of preparing and applying vitrifiable metallic colours, either contain no theory, and consequently no general principles, or give only explanations founded on hypothesis, often ridiculous, which formerly composed the theory of chemistry.

I have thought it might be of utility to the arts, and that it was the duty of the national manufactory of Sevres, to make known the pretended secret of the composition of those porcelain colours which are unalterable in the fire.

My object is not to give a detailed account of the exact composition of all the vitrifiable colours; such a labour cannot be the subject of a single memoir.

It is well known, that all vitrifiable colours have for their basis

metallic oxides; but all the metallic oxides are not proper for this purpose: besides, as they are not vitrifiable by themselves, they can scarcely ever be employed alone.

Highly volatile oxides, and those which adhere little to the great quantity of oxygen they contain, either cannot be employed in any manner, as the oxide of mercury and that of arsenic, or are employed only as agents. The colour they present cannot be depended on, since they must lose it in the slightest heat, by losing a part of their oxygen: such are the puce coloured and red oxides of lead, the yellow oxide of gold, &c.

Oxides in which the proportions of oxygen are susceptible of varying with too much facility, are rarely employed: the oxide of iron, though black, is never employed for that colour; and the green oxide of copper is, under many circumstances, very uncertain.

I have said, that alone, oxides are not susceptible of fusion: however, as they are destined to be applied in thin strata on vitrifiable substances, they may be attached to them by a violent heat. But, except the oxides of lead and bismuth, they would give only dull colours. The violent heat, often necessary to fix them, would change or totally destroy the colours. A flux then is added to all metallic oxides.

This flux is glass, lead, and silex; glass of borax, or a mixture of both.

Its general effect is, to give splendour to the colours after their fusion; to fix them on the article which is painted, by promoting, more or less, the softening of its surface; to envelop the metallic oxides, and to preserve their colour by sheltering them from the contact of the air: in a word, to facilitate the fusion of the colour at a low temperature not capable of destroying it.

Metallic oxides are employed sometimes directly, and merely mixed with their flux, without being previously fused with it. In many circumstances, oxides are fused previously with their flux, and afterwards ground. In speaking of colours in particular, I shall point out those which experience this kind of fusion.

I shall speak here only of the application of metallic colours to vitreous bodies or to vitreous surfaces.

These bodies may be divided into three classes, very distinct by the nature of the substances which compose them, the effects produced on them by the colours, and the changes they experience. These classes are:

1st. Enamel, soft porcelain, and all crusts, enamels, or glass, that contain lead in a notable quantity.

2nd. Hard porcelain, or porcelain which has a crust of feld-spar.

3d. Glass in the composition of which no lead enters, such as common window glass.

It is well known, that enamel is glass rendered opaque by the oxide of tin, and exceedingly fusible by the oxide of lead. It is the oxide of lead, in particular, contained in it, that gives it properties very different from those of the other excipients of metallic colours. Thus all glass and glazing that contain lead will participate in the

properties of enamel; and what we shall say of one may be applied to the rest with very trifling differences. Such are the white and transparent glazing of stone ware, and the glazing of porcelain called *soft glazing*.

This porcelain, which was the first made in France, and particularly at Sevres, where it was a long time manufactured almost exclusively, has for its base a vitreous frit, rendered almost opaque, and susceptible of being worked with clay, and is glazed with an exceedingly diaphanous glass, into the composition of which there enters a great deal of lead.

The colours employed in it are those which serve for painting in enamel: consequently, whatever changes these colours experience on enamel, they must experience on this kind of porcelain, since the causes of this change, which we shall mention hereafter, are the same.

Enamel or soft porcelain colours require less flux than others, because the glass on which they are applied becomes sufficiently soft to be penetrated by them. This flux may be either glass of lead and pure silex, called *rocaille*, or the same glass mixed with borax.

Montamy asserts, that glass of lead ought to be banished from among the enamel fluxes; and he employs only borax. He then dilutes his colours in a volatile oil.

On the other hand, the painters of the manufactory of Sevres, employ only colours without borax, because they dilute them in gum; and borax does not dilute well in that substance. I have found that both methods are equally good; and it is certain that Montamy was wrong to exclude fluxes of lead, since they are daily employed without any inconvenience, and as they even render the application of colours easier.

I have said that in the baking of these colours, the crust, softened by the fire, suffers itself to be easily penetrated by them. This is the first cause of the change which they experience. By mixing with the crust they become weaker, and the first heat changes a figure which appeared to be finished, into a very light sketch.

The oxide of lead which the crust contains, is a second, but much more powerful cause of the considerable changes which colours experience. The destructive action which that metal exercises chiefly on iron reds, is singularly remarkable. I shall soon give an account of some experiments, which prove it in a very evident manner.

It has been already seen, that the two principal causes of the changes, which colours on enamel and soft porcelain, are susceptible of experiencing, do not depend in any manner on the composition of these colours, but on the nature of the glass to which they are applied. When it is said, that the colours of porcelain change in a considerable degree, it ought to be added, that it is those of soft porcelain; a kind almost neglected.

It follows from what has been said, that painting on soft porcelain has need of being several times retouched, and of several heats, in order that it may be carried to the necessary degree of strength. These paintings have always a certain faintness; but they are con-

stantly more brilliant, and they never are attended with the inconvenience of detaching themselves in scales.

Hard porcelain, according to the division which I have established, is the second sort of excipient of metallic colours. This porcelain, as is well known, has for its basis a very white clay, called *kaolin*, mixed with a siliceous and calcareous flux, and for its covering, feld-spar fused without an atom of lead.

This porcelain, which is that of Saxony, is much newer at Sevres than the soft porcelain. The colours applied to it are of two kinds: the first, destined to represent different objects, are baked in a heat very inferior to that necessary for baking porcelain. They are exceedingly numerous and varied.

The others, destined to be fused in the same heat as that which bakes porcelain, lay themselves flat, and are much less numerous.

The colours of painting are made nearly like those destined for soft porcelain; they only contain more flux. Their flux is composed of glass of lead, called *rocaille*, and borax.

When porcelain is exposed to heat, in order to bake the colours, the covering of feld-spar dilates itself and opens its pores, but does not become soft: as the colours do not penetrate it, they experience none of those changes which they undergo on soft porcelain. It must, however, be said, that they lose a little of their intensity, by acquiring that transparency which is given to them by fusion.

One of the greatest inconveniences of these colours, especially in the manufactory of Sevres, is the facility with which they scale off, when exposed several times in the fire.

This inconvenience is observed more at Sevres than any where else, because it depends on the solidity and infusibility of the porcelain manufactured in that establishment. But these are qualities which make it much longer resist alternations of heat and cold, and which give to its paste a more striking whiteness. Paris porcelain, on the other hand, being more vitreous, more transparent, and bluer, often cracks when boiling liquors are put into it.

To remedy this defect without altering the quality of the paste, I was of opinion, that the crust only ought to be softened, by introducing into it more siliceous or calcareous flux, according to the nature of the feld-spar. This method has succeeded; and for about a year past, the colours might be exposed two or three times to the fire without scaling, if not overcharged with flux, and if not laid on too thick. It has been remarked, that soda and potash introduced into the colours make them scale; they are, therefore, never used as fluxes. It is found that these alkalies, by becoming volatilized, abandon the colour, which when alone, cannot form an adhesion with the crust.

The third sort of excipient of vitrifiable metallic colours, is glass without lead.

The application of these colours to glass, constitutes painting on glass; an art very much practised some centuries ago, and which was supposed to be lost, because out of fashion; but it has too direct a dependence on painting in enamel and porcelain, to be entirely

lost. Besides, a description of it may be found in a very great number of works.

The limits of a memoir will not allow me to enter into historical details respecting the art of painting on glass: a full history of it has been given in the work of Leviel. The matters and fluxes which enter into the composition of the colours employed on glass, are, in general, the same as those applied to porcelain. Neither of them differ but in their proportions; but there are a great number of enamel, or porcelain colours, which cannot be applied to glass, where they are deprived of the white ground which serves to give them relief. When seen by refraction, several of them entirely change their tone, and assume a dirty dint, which can be of no use: we shall make them known when we come to treat of colours in particular. Those which can be employed on this body, change sometimes in baking, and acquire a great transparency. In general, they are not beautiful; but, when placed between the light and the eye, they then seem to answer the only object that can be proposed in painting on glass.

The baking plates of painted glass, presents more difficulties than might be supposed. Care must be taken not to disfigure the piece, or alter the colours: all the works we have read recommend a bed of gypsum. This method has sometimes succeeded; but the glass, for the most part, becomes white and full of cracks. It appears, that glass too alkaline, (and alkalies are the most common in white glass) suffers itself to be attacked when warm, by the sulphuric acid of the sulphate of lime. We were able easily to bake pieces of glass much larger than those before painted, by placing them on very straight plates of earth, or of soft porcelain.

Of Colours in particular.

After collecting the general phenomena exhibited by each class of vitrifiable colours, considered in regard to the body on which they are applied, I must make known the most interesting particular phenomena, exhibited by each principal kind of colours employed on soft porcelain, and glass, in a porcelain furnace.

Of Reds, Purples, and Violets, made from Gold.

Carmine red, is obtained by the purple precipitate of Cassius: it is mixed with about six parts of its flux; and this mixture is employed directly, without being fused. It is then of a dirty violet, but, by baking, it acquires a beautiful red carmine colour: it is, however, exceedingly delicate; a little too much heat and carbonaceous vapours easily spoil it. On this account, it is more beautiful when baked with charcoal than with wood.

This colour, and the purple, which is very little different, as well as all the shades obtained from it, by mixing it with other colours, really change on all porcelain, and in every hand. But it is the only one that changes on hard porcelain. Its place may be supplied by a rose colour from iron, which does not change; so that by suppressing the carmine made with gold, and substituting for it the rose oxide of iron, here alluded to, you may exhibit a palette composed

of colours, none of which change in a remarkable manner. This rose-coloured oxide of iron has been long known; but it was not employed on enamel, because, on that substance it changes too much. As the painters on enamel, however, have become the painters on porcelain, they have preserved their ancient method.

It might be believed, that by first reducing to a vitreous matter the colour called *carmine*, already mixed with its flux, it might be made to assume its last tint. But the heat necessary to fuse this vitreous mass destroys the red colour, as I have experienced. Besides, it is remarked that, to obtain this colour very beautiful, it must be exposed to the fire as few times as possible.

Red, Rose, and Brown Colours extracted from Iron.

These colours are made from red oxide of iron, prepared with nitric acid. These oxides are further calcined, by keeping them exposed to the action of heat. If heated too much, they pass to brown.

Their flux is composed of borax, sand, and minium, in small quantity.

These oxides give rose and red colours, capable of supplying the place of the same colours made with oxide of gold. When properly employed, on hard porcelain, they do not change at all. I have caused roses to be painted with these colours, and found no difference between the baked flower, and that not baked, except what might be expected to result from the brilliancy given to colours by fusion.

These colours may be employed indiscriminately, either previously fused, or not fused.

The composition of them is the same, both for soft porcelain and for glass. They do not change on the latter; but on soft porcelain, they disappear almost entirely, on the first exposure to heat, and to make any thing remain, they must be employed very deep.

This singular effect must be ascribed to the presence of lead in the crust or glazing. I assured myself of this, by a very simple experiment. I placed this colour on window glass, and, having exposed it to a strong baking, it did not change.

Yellows.

Yellows are colours which require a great deal of care in the fabrication, on account of the lead which they contain, and which, approaching sometimes to the metallic state, produces on them black spots.

The yellows for hard and soft porcelain are the same: they are composed of the oxide of lead, white oxide of antimony, and sand.

Oxide of tin is sometimes mixed with them; and when it is required to have them livelier, and nearer the colour *du souci*, red oxide of iron is added, the too great redness of which, is dissipated in the previous fusion to which they are exposed, by the action of the lead contained in this yellow. These colours when once made, never change: they disappear, however, almost entirely when exposed to a porcelain heat.

These yellows cannot be applied to glass: they are too opaque and dirty. That employed by the old painters on glass, has, on the contrary, a beautiful transparency, is exceedingly brilliant, and of a colour which approaches near to that of gold. The processes which they gave, clearly showed that silver formed part of their composition; but, when exactly followed, nothing satisfactory was obtained. C. Miraud, whom I have already had occasion to mention, has found means to make as beautiful paintings on glass as the ancients, by employing muriate of silver, oxide of zinc, white argil, and yellow oxide of iron. These colours are applied on glass merely pounded, and without a flux. The oxide of iron, brings the yellow to that colour, which it ought to have after baking, and contributes with the argil and oxide of zinc, to decompose the muriate of silver, without deoxidating the silver. After the baking, there remains a dust which has not penetrated into the glass, and which is easily removed.

This yellow, when employed thicker, gives darker shades, and produces a russet.

Blues.

It is well known, that these are obtained from the oxide of cobalt. All chemists are acquainted with the preparation of them. Those of Sevres, which are justly esteemed for their beauty, are indebted for it, only to the care employed in manufacturing them, and to the quality of the porcelain, which appears more proper for receiving them, in proportion to the degree of heat it can bear.

The blue of hard porcelain, destined for what is called the ground for a great heat, (*les fonds au grand feu*) is fused with feld-spar; that of soft porcelain has for its flux, silex, potash, and lead: it is not volatilized like the preceding, but the heat it experiences, is very inferior to that of hard porcelain.

These colours, when previously fused, do not change at all in the application.

Blues on glass, exhibit the same phenomena as those on soft porcelain.

Greens.

The greens employed in painting, are made with green oxide of copper, or, sometimes with a mixture of yellow or blue. They must be previously fused with their flux, otherwise they will become black; but after this first fusion they no longer change.

They cannot stand a strong heat, as it would make them disappear entirely. Green grounds for a strong heat are composed with the oxides of cobalt and nickel, but a brownish green only is obtained.

Bluish greens called *celestial blues*, which were formerly colours very much in vogue, can be applied only upon soft porcelain; on hard porcelain they constantly become scaly, because potash enters into their composition.

These greens cannot be applied on glass: they give a dirty colour. To obtain a green on glass, it is necessary to put yellow on one side,

and blue, more or less pale, on the other. This colour may be made also, by a mixture of blue, with yellow oxide of iron. I hope to obtain from oxide of chrome a direct green colour. The trials I have made, give me reason to hope for success. Pure chromate of lead, which I applied to porcelain in a strong heat, gave me a pretty beautiful green, of great intensity and very fixed.

Bistres and Russets.

These are obtained by mixtures in different proportions of manganese, brown oxide of copper, and oxide of iron from ombre earth. They are also previously fused with their flux, so that they do not change in any manner on soft porcelain.

This colour fades very speedily on glass.

Russet grounds in a great heat, known under the name of *tortoise shell grounds*, are made in the same manner. Their flux is feldspar.

Blacks.

Blacks are the colours most difficult to be obtained very beautiful. No metallic oxide, gives alone a beautiful black. Manganese is that which approaches nearest to it. Iron gives an opaque, dull, cloudy black, which changes very easily to red: the colour-makers, therefore, to obtain a black which they could not hope for, from the best theorist, have united several metallic oxides, which separately do not give black, and have obtained a very beautiful colour, which, however, is liable to become scaly and dull.

These oxides are those of manganese, the brown oxides of copper, and a little of the oxide of cobalt. The gray is obtained by suppressing the copper, and increasing the dose of the flux.

Having here made known the principles of the fabrication of each principal colour, it may be readily conceived that by mixing these colours together, all the shades possible may be obtained. It is evident, also, that care in the preparation, choice in the raw materials, and a just proportion of doses, must produce in the results, differences very sensible to an eye accustomed to painting. A mere knowledge of the composition of colours, does not give the talent of executing them well.

In recapitulating the facts above mentioned, to present them under another general point of view, it is seen:

1st. That among colours generally employed on hard porcelain, one only, is susceptible of changing, viz. carmine, and the tints into which it enters: that its place may be supplied by the reds of iron, and that no colour then changes.

2nd. That among the colours for soft porcelain and enamel, several change in a considerable degree. These are principally the reds of gold and iron, the yellows, the greens, the browns. They have not been replaced by others, because this kind of painting has been almost abandoned.

3d. That several of the colours on glass change also by acquiring

complete transparency. These in particular are the yellows and greens.

4th. That it is neither by calcining the colours in a higher degree, nor previously fusing them, as supposed by some, that they are prevented from changing, since these means really alter the changing colours, and produce no effect on the rest. The change which several colours experience on soft porcelain, and on glass, does not then depend on the nature of their composition, but rather on that of the body on which they are applied.

Consequently, by suppressing from the colours of hard porcelain, the carmine of gold, which is not indispensably necessary, we shall have a series of colours which do not change.

On the valuable Properties of the genuine Emery Stone; and on a superior Process of washing over Emery, invented by Mr. JOHN ISAAC HAWKINS.

THE genuine emery stone is brought to us from *Naxos*, one of the islands in the Greek Archipelago. It is found in hard, compact, stony masses, of a bluish purple colour, interspersed with pyrites. These lumps of emery are used in their native state, in Sweden, to shape porphyry into slabs, mortars, &c.; being held firmly against the masses of porphyry, whilst the latter are turned in large lathes, moved by the power of water. They are also used in this country by the glass cutters, to turn their cast iron laps into shape; and the emery made from them is greatly preferable to any other, in its effects upon the articles to be cut or abraded by it, owing to its great hardness. This valuable property of hardness, however, has increased the difficulty of manufacturing emery from it; and, accordingly, substitutes have been found for it, which fall vastly short, indeed, in this desirable quality. We have even been told, that *the clinkers from a smith's forge* are too often made into what is called emery! We would therefore recommend those persons who wish to obtain emery of a superior description, to make it themselves, of the genuine Greek emery stone, by reducing it to powder in a cast iron mortar with an iron pestle; and then, either sifting it to the required degree of coarseness or fineness, with proper wire sieves; or else, by washing it over in water, as usual, bring it to a state of minuter division, and as described in our article "On Grinding and Polishing Lenses." [See p. 396, Vol. IV.]

On Mr. J. I. Hawkins' Improved mode of Washing Emery.

We have lately been favoured, through the kindness of Mr. Hawkins, with an account of his very superior manner of preparing emery *for nice purposes*. He was induced to effect this, by finding that the emery commonly sold was totally inefficient for the purpose he had in view; namely, grinding two flat surfaces of hard cast-steel accurately; as the workman found that only a few of the coarser parts of

the emery scratched the surfaces of the steel plates, and kept the remainder of it from acting at all; and, in fact, that his labour was in vain. On this, Mr. Hawkins thought of applying to emery, a process which he had seen used in Liverpool for washing over *diamond-dust*, to be used in watch jewelling: and, in order to be sure that his emery should be of a good quality, he took the precaution of purchasing, at an eminent emery maker's, a quantity of those small lumps or grains of emery which had longest withstood the action of the cast iron runners and bed; and thus ensured the *hardness* of the emery. These lumps he caused to be reduced to powder in a mortar of cast iron, as we have above mentioned; and then sifted the powder into different varieties, by passing it through a series of wire sieves; the first sieve having 20 squares in the inch, the next 30, and so on to 80: and thus he obtained eight different degrees of emery.

He next treated the emery which had passed through the finest sieve, by washing it over in the same manner as the diamond-dust was treated; namely, in *oil, which held it suspended for a much longer time than the water, which is usually employed for this process:* and in this way he obtained a series of emery, which had floated one minute, five minutes, ten minutes, fifteen minutes, twenty minutes, forty minutes, and eighty minutes; amongst which he found every variety necessary for his purpose, and deposited them in separate boxes for use, numbered according to the minutes they had floated: and he could thus, at any subsequent period, be certain of producing other emeries of the very same description.

We need hardly add, that, by using these latter emeries in succession, beginning with the coarsest, he not only very soon accomplished the object he had in view, but has also since employed them in grinding three flat circular plates of cast iron, to perfectly plane surfaces; correcting, as usual, the tendency in either to become concave or convex, by means of the third plate.

Emery hard enough to cut Rubies.

Mr. Hawkins, pursuing the same practice of selecting those grains of emery which resisted longest the action of the pestle and mortar, eventually obtained some *so hard*, as to be capable of *cutting a ruby*, when employed in a manner similar to *diamond-dust* in watch jewelling.

Sapphires found in the Greek Emery Stone.

The editor has lately treated some portions of the Greek emery stone, by grinding them to powder between two flat and hard steel surfaces, and washing off the lighter parts in oil: he then placed a small portion of what had subsided, after floating only half a minute, upon a slip of glass, and examined it in the microscope, under a highly magnifying power; and found that many parts of it had entirely withstood the grinding action, (except, only, their being separated from the mass,) and were, in fact, *perfectly crystallized sapphires.* [*Technical Repository.*

Illiberal views on the London University, under the title of 'Institutions for the Instruction of the Lower Classes.' From Bell's Weekly Messenger. With remarks by the Editor.

In a late number of 'The Albion,' published in New York, we find, under the above title, the subjoined article, copied from '*Bell's Weekly Messenger.*' The Editor of the Albion says "To its sentiments with regard to the absence of religious instruction we fully subscribe, and it is with a view to giving currency to them, that we are mainly induced to transfer the article to our columns; but we, at the same time, beg to disclaim any participation in the illiberality manifested towards our fellow subjects north of the *Tweed.*"

'*We*, are mainly induced to transfer the article to our pages,' for the purpose of affording, by contrast, one proof, among thousands which might be selected, of the eminently favourable influence of free institutions which are purely civil, over those which are connected with national ecclesiastical establishments, in promoting the universal diffusion of knowledge.

Our readers, generally, are aware that a number of influential, liberal, and enlightened individuals, have associated, and munificently contributed, for the purpose of establishing a University in the city of London, not for the instruction of the *lower* classes, but in order to extend the benefits of a liberal education to the sons of those citizens, whose circumstances, or whose religious opinions, prevent their admission into the national Universities. In the ardour with which this plan has been promoted by men high in official station, many of whom are warmly attached to the church, as a religious institution, we witness the triumph of the spirit of the times, over that domineering hierarchy, which in other periods has taught, that 'ignorance is the mother of devotion;' whilst in the tone of malignant asperity which pervades the observations before us, there is manifested a complete absence of the benign influence of christianity, and a fear evinced, that the faith of those may be shaken, who have been taught to believe, that the image of the goddess Diana, actually fell down from heaven.

We are not about to enter upon any religious, or political controversy; this is quite as foreign to our inclination, as it is to the objects of this Journal; but whilst public institutions for scientific and moral instruction, are, as they ever must be, greatly influenced by the religious and political establishments of a country, we should deem ourselves reprehensibly fastidious, were we to avoid a passing notice of their connexion, when speaking of the diffusion of knowledge.

We are so far from apprehending that observations written in a tone of such malignant asperity will aid the cause which they profess to espouse, that supposing them to have been foisted upon the London editor, by some friend of the University who wished to exhibit a picture of its enemies in strong caricature, we should think that the effort must have been very successful: the editorial form given to the article, seems, however, to forbid the serious formation of such a conjecture.

"We have always been a friend to the Mechanic Institutions which are now so common in the kingdom, and we are much disposed to applaud those publications which are now weekly issued for the instruction of the lower orders, in philosophy, science, and the mechanic arts. There is, perhaps, a good deal of pretension in these books, and in the plan itself, and they will not altogether, we apprehend, answer their purpose. These weekly lectures are very abstruse; they are written with little elegance, or illumination of style, and present science, (which, in its elements, is always difficult and without attraction,) in a very uncouth dress. But the attempt is certainly praiseworthy, and we trust it will answer the purpose of the booksellers.

"We cannot, however, extend the like good wishes to the London University; for, though no one can wish better to the interest of the great majority of the inhabitants of London than ourselves—and though we have, as we may truly say, a direct interest in their education, and in the active curiosity and habits of reading to which such an education leads, we must be allowed to express our most decided opinion against the necessity and utility of this Metropolitan College, —which is now, we think, at a stand, or, at least, somewhat in the wane. As a means of diffusing science, it is a piece of quackery. As a corporate body, or even as a large assemblage of men, united together in a pursuit and profession, above all others, pregnant with self-conceit and presumptuous arrogance, it will be full of danger to the established institutions of the country.

"In the first place, the very character and professed objects of such a University, its mode of institution, and the fundamental principle upon which it professes to open and to proceed, is contrary to the very nature of a University, or Collegiate Institution. What, in fact, is a suitable notion of a University?

"A University is a civil institution for the purposes of educating the members of a state for the learned professions, and for the lay and ecclesiastical orders of the community, and patronized and protected by the state, because the principles of education are conformable with the government and constitution of the country; and because such education assists the due progress of government and its daily administration. A University, therefore, is a civil institution of the state, recognising its establishments, and directing its course of education towards maintaining and upholding the government and its orders. Upon what principle, therefore, can the state be called to patronize, or even allow, a confederacy of teachers and lecturers, who profess to have no reference to, or connexion with, the establishments of the country, but systematically put out of their view the first and principal of our civil and religious institutions? What right has such a confederacy to the application of the public and civil appellation of a University; that is to say, to be considered as a part of the state, and a member of the orders of the realm? We have lived, however, too long to found arguments upon mere words, and upon a mere inconsistency between the thing and its appellation. Our main assertion is this,—that such an institution cannot be friendly either to the church—to the ancient and established Univer-

sities—nor to the state itself. And a very few words will, we think, make this appear.

"As regards the church, the principles of this Scottish confederacy,—this Lancaster college,—this Birkbeck University, are, that the system of education shall be wholly and systematically indifferent to all religious instruction altogether; that the name of religion shall never be mentioned, and that Jew, Turk, Infidel, and Scotch lecturers, shall be equally welcome, and enjoy a perfect equality. Now, let us ask any one acquainted with the human heart, and with the certain course of human habits and feelings, what will necessarily be the state of mind, of feelings, of habits, as to religion, of the youth so educated, so systematically taught to regard all religion as a matter of perfect indifference?

"In what we daily and hourly see amongst ourselves, in our own warehouses and workshops, in this great metropolis, what kind of youths do we find those to be, who have been brought up in a total neglect of all religious duties—of Sabbath worship, and of any prayer, either public or private? Do we, in a word, ever find any one religious, or giving religion a thought, unless they have been educated in it, and to it, from childhood? Does not the daily experience of life show, that God, in the distribution of his blessings, always acts by aiding, assisting, and co-operating with second means, and that religious instruction by parents is the secondary means, which his wisdom has appointed, to continue religion to our children?

"In short, we feel it unnecessary to argue with any length now upon this subject, or to say more than to recall to memory the positive command in our Scriptures to *teach* children the fear of God,—to bring them up in the nurture and admonition of piety.

"But according to this University system, this Scotch education manufactory, every one is to be left to himself. 'No,' you say, 'to their parents.' But when parents send their children to school or to the University, such school or University becomes their instructors, and the parents deem it unnecessary to occupy themselves any longer in their instruction. Let us not be deceived by words,—let us remember only what daily passes in our own houses and families; and let us think, and think seriously, what will be the state of our children under such instructors. Not only the disuse and mere absence of all religious subjects, but a systematic indifference and contempt towards it, legibly written in the very principles of the system.

"As to the spirit with which this Owen University, this Lanark College, with its Scotch chancellor, and vice-chancellor, will regard the ancient Universities of the realm, is it a matter of doubt for a moment, how a drove of prating and conceited professors, lecturing on the principles and practice of carpentry, the friction of wheels, and the laws of the universe, will regard the quiet and noiseless science of their competitors at Cambridge? which every year (every single year, without exception) produces, not one or two, but a long list of men, and those very young men, not exceeding two or three and twenty years of age, in comparison with whom their highest professor would be but a school-boy. Has Glasgow or Edinburgh

one man, even one, who could stand a comparison with the first wrangler of any year at Cambridge? And does Mr. Brougham himself know what mathematics and science are, when he talks so fluently of rendering labouring mechanics mathematicians, by his London University? He might as well, indeed, with much more hope of success, make a London University for lawyers.

"In a word, we wish well to every thing which can add to human virtue and happiness. But this lay, London, University will administer to neither of these great ends. It will bring the conceit of the modern Athens into the midst of us, and will teach so many to talk and dispute, that we shall have none to work. We shall have as many lecturers as labourers, and the tutors and professors will be as troublesome in our families, as were the Jesuits in old times. The mischief will begin with our sons, and perhaps, as the lectures are to be public, will extend to our wives. A plain man will have a Scotch reason assigned to him against every thing he proposes; there will be an end of all peace and quietness, and what is worse, of all admitted principles in truth and morals. Mr. Brougham and Mr. T. Campbell are very eloquent, and doubtless very learned men, but we shall repent it, if we bring them into the common council, and ask their advice how we shall educate our sons and apprentices."

Notice of an attempt to Navigate the air by means of Kites.

[From a London paper.]

We noticed a short time since in the scientific department of our Magazine, the project of a gentleman of the name of Pocock, a schoolmaster of Bristol, for propelling a species of wheel carriage by means of the power of *kites*. An experiment made with this *charvolant*, some months back, near Windsor, in which it overtook and outstripped the carriage of the Duke of Gloucester, (his highness chancing to pass the same way,) was noticed at the time, by several London and provincial papers; and Mr. Pocock has now published a quarto book in explanation of his invention, interspersed with plates—some exhibiting men flying in the air at the tails of kites—others, ships at sea, and stranded, sending messengers to shore by them—others, carriages drawn over hill and dale by them—which horsemen riding *ventre a terre*, as the French describe it, are unable to overtake; altogether, a work as wild and eccentric as some persons will consider the discovery itself.

The objects—that is to say, the more important objects—to which Mr. Pocock finds his invention particularly applicable, are three in number: the propelling of ships in calm weather at sea; the drawing of carriages by land; and the elevating of individuals to enormous heights in the air, for the purposes of observation, escalade of fortresses, crossing of rivers, or any other acts for which such an exalted location may be considered available. All these works, he assures the public, have been *experimentally accomplished* by the kites; and although the author himself admits that some of his ac-

counts have been thought a little strange by people not habitually incredulous, yet there is considerable curiosity in the steps by which his invention has been brought to its present state, as well as approved truth in many of the results which he describes to have been obtained from it.

Mr. Pocock informs us, that having, when a boy, conceived some notions of the probability of making the drawing power of a kite applicable to useful purposes in life, it became an object with him, of course, in the first place, to try to what extent the force of the engine in question could be carried. With this view, he conceived the idea of procuring *two* paper kites; and flying up the *first* until *it would carry no more string*, he then tied the end of the first kite string, to the back of the second kite; and letting *that* up with its own length of cordage, he soon discovered that by adding *kite after kite* in this manner, an almost indefinite extent of power and elevation might be obtained. Encouraged by having fixed this principle, he proceeded in his labours; making a variety of improvements almost immediately, in the construction and management of his kites; such as building them *jointed*, in order that when of a large size they should be more portable; covering them with *linen* instead of paper, that they might be proof against the weather; and, particularly, furnishing them with three cords, (independent of the main, or drawing string,) called *brace lines*, the effect of which was to regulate their power when elevated, and to direct their course, without being left entirely at the discretion of the wind, through the atmosphere; until, at length, having further constructed a carriage peculiarly adapted to the application of his new impulse, he arrived so far at success, as to be able upon ordinary roads to perform journeys at the rate of twenty miles an hour; and to outstrip, as has already been stated, on one occasion, the carriage of the duke of Gloucester, with his royal highness's postilions, (as he says,) putting their horses to the gallop.

For a full account of many strange matters that occurred in the course of the inventor's experiments, our readers must consult the book itself: but the practicability of impelling a carriage along a common road by the aid of kites, certainly seems established beyond all doubt. On one trial, (on the 8th January in the present year,) the projector performed a mile of ground over a very heavy road, in *two minutes and three-quarters;* and on the same day, several other miles in *three minutes* each. This was done between Bristol and Marlborough. At another time, he says he beat a London stage coach, in a distance of *ten miles*, by no less than *twenty-five* minutes. Moreover, as although by the assistance of the *brace lines*, his kites work perfectly well with a *side* wind, it is impossible for them to work *against* the wind, and consequently not easy for a traveller to go a journey with them, and come back, (the wind remaining in the same quarter,) in the same day—to obviate every difficulty, the inventor has added *a platform to the back of his kite-carriage*, upon which *a pair of horses are carried along with the traveller!* remaining at all times fresh and in order, ready to be harnessed and set to work, in case the wind should fall, or veer round, or any other accident

should make the ministry of such animals necessary!—These are the sort of speculations that every now and then make Mr. Pocock's narrative a little staggering.

The power of a kite twelve feet high, with a wind blowing at the rate of twenty miles an hour, is as much, our author says, as a man of moderate strength can stand against. Larger kites, of course, would have their power in proportion.

Beyond drawing carriages, [by the way, how admirably these engines would do to tow canal boats?] Mr. Pocock, as we have already observed, looks that his kites shall be useful in propelling ships in calm weather. This expectation is founded upon the following fact:—Experiments have shown, he says, that when a dead calm exists upon the level or surface of the sea—at the height of 150 feet in the air, a current of wind is often running at the rate of sixteen miles an hour. By elevating his kite in due time, the voyager would have the advantage of this breeze, while those ships unprovided therewith, would lie like logs upon the water, with their sails flapping.

In cases of shipwreck upon a lee-shore, nothing of course would be more easy than to send a rope or a grappling iron to the top of a cliff by the same sort of conveyance: but should it be deemed more expedient at once to send *a person* on shore, he may be borne, the author says, "above the bursting billows, and alight, like a messenger of good from the flood," upon the cliff or beach, as the case may be! In fact, he adds, if it so happened that female passengers or children were in the vessel so situated—"what mode could be so desirable as to swing them securely in a hammock or cot, and thus transport them above the foaming billows, and land them dry shod on the shore?" And again, "these kites having power to elevate one in the air," might be of the highest use in military service: as from such "flying observations, all the movements and manœuvres of an army might be distinctly marked."

As *this* particular portion of Mr. Pocock's plan is the most curious and surprising, we regret that he has not been more careful in communicating the details of his experiments with respect to it. He pledges himself in distinct terms, that the thing—that that sort of elevation—*has been done;* and that "his daughter, who earnestly claimed from him the daring honour, was the first aeropleust." Still this is all the account we have of what has been effected in the way of *actual ascension into the air*, while the notices of experiments upon *terra firma* are given with the greatest possible amplitude and particularity.

For the present, however—certainly regretting the absence of information upon this material point, and also that his work generally is written in a style which makes it difficult to distinguish, sometimes, whether he is in jest or earnest—we must leave Mr. Pocock and his invention; not at all prejudicing our right to return to the discussion of his operations, hereafter. As the thing stands, what has been done is very amusing, and displays great ingenuity; but we rather doubt the possibility of applying the power to any purposes beyond those of diversion. When the public, however, shall be possessed

of more ample details as to the *extent* and *result* of Miss Pocock's or any body else's "*aeropleustic*" *elevation*, we shall then be better qualified to offer an opinion upon the probable eventual success of the author's project.—[*London Paper.*

Remarks by the Editor.—We insert the foregoing, principally, for the purpose of amusing our readers, at the expense of the great projector of this new mode of flying; we are aware, however, that it may also answer the useful purpose of comforting some of our own fellow citizens, whose grand schemes for 'surmounting insurmountable obstacles,' are occasionally obscured, if not eclipsed, by discoveries made on the eastern shores of the atlantic. By a reference to the Biography of Alexander Wilson, in our third volume, it will be seen that Mr. Pocock's plan of attaching one kite to another, has not itself the claims of novelty, although the object which he proposes to accomplish, namely, that of ascending in the air, at the end of the tail, is altogether so; when he accomplishes this, aided, perhaps, by a high wind, and a magnificent kite, made from the mainsails of a few of his majesty's first rates, he may hang his hat upon one of the horns of the moon.

On the Use of Perfumes in preventing the formation of Mouldiness.

By John MacCulloch, M. D.

There are many cases of daily occurrence, in which the growth of those minute vegetables that constitute mouldiness, is a very troublesome inconvenience. As your Journal does not despise the useful, I need make no apology for a communication that has no other quality to recommend it.

I do not pretend to account for the mode in which perfumes act in producing this effect; nor do I know the limitations with respect to these: but I have found it hold good with all the essential oils that I have tried, and that even when used in a very minute quantity.

Ink, paste, leather, and seeds, are among the common articles which suffer from this cause, and to which the remedy is easily applicable. With respect to articles of food, such as bread, cold meats, or dried fish, it is less easy to apply a remedy, on account of the taste. Cloves, however, and other spices whose flavours are grateful, may sometimes be used for this end; and that they act in consequence of this principle, and not by any particular antiseptic virtue, seems plain, by their preventing equally the growth of minute cryptogamous plants on ink, and other substances not of animal nature.

The effect of cloves in preventing the mouldiness of ink, is indeed generally known; and it is obtained in the same way by oil of lavender, in a very minute quantity, or by any other of the perfumed oils.

To preserve leather in the same manner from this effect, is a matter of great importance, particularly in military storehouses, where

the labour employed in cleaning harness, and shoes, is a cause of considerable expense; and where much injury is occasionally sustained from this cause. The same essential oils answer the purpose, as far as I have had an opportunity of trying, effectually. The cheapest, of course, should be selected; and it would be necessary to try oil of turpentine, for this reason. The total interruption of all my pursuits has hitherto prevented me from carrying these trials as far as I intended.

It is a remarkable confirmation of this circumstance, that Russia leather, which is perfumed with the tar of the birch-tree, is not subject to mouldiness, as must be well known to all who possess books, thus bound. They even prevent it from taking place in those books bound in calf, near to which they happen to lie. This fact is particularly well known to Russia merchants, as they suffer bales of this article to lie in the London docks in the most careless manner, for a great length of time; knowing well that they can sustain no injury of this nature from dampness, whereas, common curried leather requires to be opened, cleaned and ventilated. Collectors of books will not be sorry to learn, that a few drops of any perfumed oil will ensure their libraries from this pest.

I had commenced some trials on wood, on the same principle, with the view of preserving it from what is called the dry-rot; and, as it seemed to me, with effect. But as I have now no hopes of pursuing this subject, I am glad to have an opportunity, by your means, of putting it into better hands. A cheap oil, of course, would be required for operations so extensive as this.

The next substance that I shall point out, is paste, which is a very perishable article. Alum, which is used by the book-binders, although it preserves that most necessary substance longer than it would remain useful without it, is not very effectual. Rosin, sometimes used by shoemakers, answers the purpose better, and appears to act entirely on this principle. It is, however, less effectual than even oil of turpentine. Lavender, and the other strong perfumes, such as peppermint, anise, and bergamot, are perfectly effectual, even in a very small quantity; and paste may thus be preserved for any length of time.

Your mineralogical readers in particular, who have frequent occasion to use paste for their labels in very small quantities, and where the trouble of thus making it on every fresh occasion is inconvenient, will be glad to know that this useful article may be made to keep, even for years, always ready for use, and subject to no change.

That which I have long used in this manner, is made of flour in the usual way, but rather thick, with a proportion of brown sugar, and a small quantity of corrosive sublimate. The use of the sugar is to keep it flexible, so as to prevent its scaling off from smooth surfaces; and that of the corrosive sublimate, independently of preserving it from insects, is an effectual check against its fermentation. This salt, however, does not prevent the formation of mouldiness. But as a drop or two of the essential oils above mentioned is a com-

plete security against this, all the causes of destruction are effectually guarded against. Paste made in this manner, and exposed to the air, dries without change to a state resembling horn; so that it may at any time be wetted again, and applied to use. When kept in a close covered pot, it may be preserved in a state fit for use at all times.

This principle seems also applicable to the preservation of seeds, particularly in cases where they are sent from distant countries by sea, when it is well known that they often perish from this cause. Dampness, of course, will perform its office at any rate, if moisture is not excluded; yet it is certain that the growth of the vegetables which constitute mould, accelerate the evil; whether by retaining moisture, or by what means, is not very apparent. This, in fact, happens equally in the case of dry-rot in wood; and, indeed, in all others where this cause operates. It is a curious illustration of the truth of this view of a remedy, that the aromatic seeds of all kinds are not subject to mould, and that their vicinity prevents it in others with which they are packed. They also produce the same effect daily, even in animal matters, without its being suspected. Not to repeat any thing on the subject of cookery, I need only remark, that it is common to put pepper into collections of insects, or birds, without its having been remarked that it had the same power of keeping off mould, as of discouraging or killing the *Ptinus omnivorus*, or other insects that commit ravages in these cases.

In concluding these hints, I might add, in illustration of them, that gingerbread, and bread containing carraway-seeds, is far less liable to mouldiness than plain bread. It will be a matter worthy of consideration, how far flour might be preserved by some project of this kind. [*Ed. Phil. Journal.*

On a beautiful Blue Colour. By M. BRACONNOT.

A PORTION of a very fine blue pigment was placed in the hands of M. Braconnot, by M. Noel, for examination. It was the produce of a manufacture at Schweinfurt, where the preparation was kept secret. M. Braconnot readily ascertained it to be a triple compound of arsenious acid, hydrated deutoxide of copper, and acetic acid; so that it approximates to the green of Scheele. After various trials to form it, the following process was found to be the best. Six parts of sulphate of copper were dissolved in a small quantity of water; also, six parts of white arsenic, with eight parts of potash of commerce, were boiled in water, until no further quantity of carbonic acid was disengaged. This hot solution was gradually mixed with the first, continually agitating until effervescence ceased; an abundant dull yellowish green precipitate was formed. About three parts of acetic acid were then added, or such a quantity, that a slight excess was sensible to the smell; gradually the precipitate diminished in volume, and in some hours, a slightly crystalline powder was deposited at

the bottom of an entirely colourless solution. The fluid was poured off as soon as possible; and the powder, washed with plenty of boiling water to remove the last portions of arsenic, was then of a brilliant colour.

Care must be taken not to add to the cupreous solution an excess of arseniate of potash, as it causes waste of the acetic acid afterwards added, as the latter must be in excess. In repeating the process in the large way, an arseniate of potash, prepared with eight parts of oxide of arsenic, instead of six, was used, and the result was very successful. M. Braconnot thinks that probably a slight variation of the proportions he has given may be found advantageous; but in the mean time considers it right to give the best process he is able for the preparation of a colour so beautiful, and which may be very valuable in the arts. [*Ann. de Chim.*

Account of Mr. Barton's *Method of making the Iris Metal Ornaments, or of Ornamenting Steel and other Metals, with the Prismatic Colours.*

Mr. Barton, of the Mint, a gentleman well known for his ingenuity and his mechanical attainments, has recently conceived the happy idea of ornamenting steel, and other articles, with the colours of striated surfaces, and has secured, by patent, the exclusive privilege of applying this principle to practical purposes. The excellence of Mr. Barton's engine has, no doubt, enabled him to execute this kind of work, with a beauty and precision which no other person can hope to imitate. The engine which he uses was given to him by his father-in-law, the late celebrated Mr. Harrison. It was constructed by Mr. Harrison himself, and its merits depend chiefly on the beauty and correctness of the screw; the apparatus for cutting which, by an excellent inclined plane, also accompanied the engine. The plate on the screw is not divided higher than the 2000dth part of an inch; but Mr. Barton has drawn divisions on steel and glass so minute as the 10,000dth part of an inch. In drawing lines of 2000 in an inch, Mr. Barton often leaves out *one line* intentionally; and one of the greatest proofs of the stability of his engine is, that after having taken off the brass table, with the work upon it, (when the omission is distinctly perceived,) *he can restore it to its place, and introduce the line, without its being distinguishable from the rest.*

In applying the principle of striated colours to ornament steel, the effect or pattern is produced upon the polished surface, by the point of a diamond; so that either the whole, or a part of the surface, is covered with lines or grooves, whose distance may vary from the 1000dth to the 10,000dth of an inch. When these lines are *most distant*, the prismatic images of the candle, or any luminous body, seen by reflection from the polished surface, are *nearest* one another, and the common colourless image; and when the lines are *least dis-*

tant, the coloured images are *farthest* from one another, and the colours are most vivid.

In daylight, the colours produced by these minute grooves are scarcely distinguishable, unless at the boundary between a dark and a luminous object: and we conceive that their brilliancy will be very much impaired, even with artificial lights, when they are dispersed by the interposition of globes, or hemispheres of ground glass.

In sharp lights, however, and particularly in that of the sun, the colours shine with extraordinary brilliancy, and the play of tints which accompany every luminous image, can only be equalled by their matchless exhibition in the reflections of the diamond. The surface of fine steel, therefore, when grooved by such a skilful hand as Mr. Barton's, is peculiarly fitted for imitative jewels, and other articles of female dress: and we have no doubt that it will find an application to many other purposes, both of use and ornament.

The divisions which Mr. Barton most commonly uses for his metal ornaments are 2000 to an inch; but when the material is good, his engine enables him to divide to 5000 and 10,000. When the lines, however, are so close, the labour is very great; but the beauty of the work is generally a compensation for the time bestowed upon it, as the strength of the colours increases with the number of lines. The depth of the line, Mr. Barton finds to have a great effect in producing brilliancy, owing to the increase in the quantity of reflected light; and he is, in some measure, enabled to judge of the depth, by the faintness of the reflected image of his eye, when looking perpendicularly at the steel, until at last, by totally removing the original surface, in consequence of the edges of the cut meeting, the whole surface looks black, and the eye is no longer seen.

Since the preceding notice was written, Mr. Barton has had the kindness to favour us with various specimens of the ornaments executed by his engine; and high as our expectations were, we confess they were greatly surpassed by the work itself.

Some of the specimens are struck from steel dies, containing the grooved pattern, and it is singular to observe the perfection with which the impress of such delicate work has been conveyed.

[*Ed. Phil. Journal.*

On the ancient Grecian method of Painting in Encaustic. *By* Miss E. J. Greenland.

[From the Transactions of the Society for the Encouragement of Arts, &c. &c.]

The well known disadvantages that paintings in oil lie under, have rendered the discovery of some other vehicle, an object of attentive inquiry among the learned; and dissertations have been written on the subject by various authors, as Count Caylus, Muntz, &c.

Wax has been universally considered as the most likely substance to supply the place of the oil; and most of the writers have recom-

mended the uniting it with alkaline salts, into a kind of soap, for that purpose: the impropriety of such a measure is evident to any one in the least acquainted with the properties of those salts.

The brilliancy of the colours in the picture painted by Miss Greenland, fully justifies the opinion that the method made use of by her, provides against all those inconveniences.

Miss G. says, "I was extremely fortunate when at Florence, the summer before last, in the acquaintance of an *amateur* of painting, who procured me the satisfaction of seeing some paintings in the ancient Grecian style, executed by Signora Parenti, a professor at that place, who received her instructions from a Jesuit, at Pavia, the person who made the farthest discoveries in that art. My friend, knowing I was fond of painting, very politely informed me what were the materials the paintress used; but could not tell me the proportions of the compositions: however, from my anxiety to succeed in such an acquisition, I made various experiments; and, at last, obtained such a sufficient knowledge of the quantities of the different ingredients as to begin and finish a picture, which I shall be happy to lay before the society for their inspection."

The ancient Grecian method of Painting.

Take an ounce of white wax, and the same weight of gum-mastich, in tears, that is, as it comes from the tree, which must be reduced to a coarse powder. Put the wax in a glazed earthen vessel, over a very slow fire, and when it is quite dissolved, strew in the mastich, a little at a time, stirring the wax continually, until the whole quantity of gum is perfectly melted and incorporated; then throw the paste into cold water, and when it is hard, take it out of the water, wipe it dry, and beat it in a Wedgewood's mortar; observing to pound it at first in a linen cloth, to absorb some drops of water that will remain in the paste, and would prevent the possibility of reducing it to a powder, which must be so fine as to pass through a thick gauze. It should be pounded in a cold place, and but a little while at a time; as, after long beating, the friction will, in a degree, soften the wax and gum; and, instead of their becoming a powder, they will return to a paste.

Make some strong gum-arabic water, and when you paint, take a little of the powder, some colour, and mix them together with gum-water. Light colours require but a small quantity of the powder; but more of it must be put in proportion to the body and darkness of the colours; and, to black, there should be almost as much of the powder as of the colour.

Having mixed the colours, and no more than can be used before they grow dry; paint with fair water, as is practised in painting with water-colours; a ground on the wood, being first painted, of some proper colour, prepared in the same manner as is described for the picture:—walnut tree and oak, are the sorts of wood commonly made use of in Italy for this purpose. The painting should be very

highly finished, otherwise, when varnished, the tints will not appear united.

When the painting is quite dry, with rather a hard brush, passing it one way, varnish it with white wax, which is put into an earthen vessel, and kept melted over a very slow fire, till the picture is varnished; taking great care that the wax does not boil. Afterwards, hold the picture before a fire, near enough to melt the wax, but not to make it run; and when the varnish is entirely cold and hard, rub it gently with a linen cloth. Should the varnish blister, warm the picture again slowly, and the bubbles will subside.

When the picture is dirty, it need only be washed with cold water.

After the experience of some years had suggested some improvements, Miss G. made the following communication.

Method of uniting wax and mastich with water, in making a composition for Painting, in imitation of the ancient Grecian manner.

Put into a glazed earthen vessel, four ounces and a half of gum-arabic, and eight ounces of cold spring water: when the gum is dissolved, stir in seven ounces of gum-mastich, which has been first washed, dried, and beaten fine—which is very soon done: set the earthen vessel, containing the gum-water and gum-mastich, over a moderate fire, continually stirring and beating them hard with a spoon, in order to dissolve the gum-mastich. When sufficiently boiled, it will no longer appear transparent, and will be stiff like a paste. So soon as this is the case, and that the gum-water and mastich are quite boiling, without taking them off the fire, add five ounces of white wax, broken into small pieces, stirring and beating the different ingredients together, till the wax is perfectly melted, and has boiled: then take the composition off the fire; as boiling it longer than necessary, would only harden the wax, and prevent its mixing so well afterwards with water. When the composition is taken off the fire, and in the glazed earthen vessel, it should be beaten hard; and, whilst hot, but not boiling, mix with it, by degrees, sixteen ounces of cold spring water; then strain the composition, as some dirt will boil out of the gum-mastich, and put it into bottles.

The composition, if properly made, should be like cream, and the colours, when mixed with it, as smooth as if with oil. The method of using it, is, mixing the colours with it as with oil; then paint with fair water. The colours, if grown dry, when mixed with the composition, may be used by putting a little fair water over them; but it is less trouble to put some water, when the colours are observed to be growing dry.

In painting with this composition, the colours blend without difficulty, when wet; and even when dry, the tints may be easily united by means of a brush, and a very small quantity of fair water.

When the painting is finished, put some white wax into a glazed

earthen vessel, over a slow fire; and, when melted, but not boiling, with a hard brush cover the painting with the wax; and when cold, take a moderately hot iron, such as is used for ironing linen, and draw it lightly over the wax. When the picture is nearly cold, rub it with a fine linen cloth to make it entirely smooth; and when quite cold, rub it again to make it shine.

Paintings might be executed in this manner upon wood, or plaster of Paris, without requiring any other preparation than mixing some fine plaster of Paris, in powder, with cold water, to the thickness of cream; then pour it on a looking-glass; and when dry, take it off; and there will be thus formed, a very smooth surface for painting upon.

Paintings may also be done in the same manner, with gum-water and gum-mastich only, prepared the same way as the mastich and wax; but, instead of putting seven ounces of mastich, and when boiling, adding five ounces of wax; mix twelve ounces of gum-mastich with the gum-water, before it is put on the fire, and when sufficiently boiled and beaten, and it is a little cold, stir in twelve ounces of cold spring water, and afterwards strain it.

It would be equally practicable to paint with wax alone, dissolved in gum-water, in the following manner.

Weigh twelve ounces of cold spring water, and four ounces and a half of gum-arabic: put them into a glazed earthen vessel, and when the gum is dissolved, add eight ounces of white wax. Put the earthen vessel, with the gum-water and wax, upon a slow fire, and stir them till the wax is dissolved, and has boiled a few minutes; then take them off the fire, and throw them into a basin; as, by remaining in the hot earthen vessel, the wax might become rather hard: beat the gum-water and wax, till quite cold. As there is but a small portion of water, in comparison to the quantities of gum and wax, it would be necessary in mixing the composition with the colours, to put also some fair water.

It should be observed, that the water used by Miss Greenland in these preparations, came from a chalk rock, and was remarkably soft: possibly, any other water might answer equally well.

Origin and History of Glass.

The word glass is supposed to be derived from the German *glessum*, the name for amber, which it was thought to resemble in its transparency and brightness. Some imagine glass to have been invented before the flood, and that Moses alluded to the sands that glass was made of, when he said to Zebulon—"They shall suck of the abundance of the seas, and of treasures hid in the sand;" for in the inheritance of that tribe, or very near the frontier of it, ran the little river Belus, where a particular kind of sand was to be found, of great use in the manufacture of glass; which Pliny corroborates by informing us, that glass was first accidentally discovered in Syria, at the mouth of the river Belus, by certain merchants driven

thither by the fortune of the sea, who being obliged to live there and dress their victuals by making a fire on the ground, collected some of the plant kali, of which there was an abundance on the spot, for that purpose: this herb being burnt to ashes, occasioned a vitrification of the sand and stones that adhered to it, thus producing glass, and affording a hint for the fabrication of it.

The period when this discovery was made, is involved in considerable obscurity; for it seems to be the general opinion, that what has been denominated glass in the Old Testament, as well as in some of the translations from ancient Greek authors, ought rather to have been termed crystal: however, our knowledge of this invention is principally derived from the Romans; though Theophrastus, who lived about 300 B. C., has given us some account of glass, which he also describes as being made of the sand of the river Belus.

The first glass-houses were erected at Sidon, near the mouth of the Belus; but the glass-houses of Alexandria, were most celebrated among the ancients, for the skill and ingenuity of the workmen employed in them; and from these the Romans for a long time procured all their glass-ware.

Lucretius, who wrote about 60 B. C., is the earliest among the Latins who makes any mention of glass, which appears to have been brought into use at Rome in the time of Augustus: and, if the following anecdote be true, the manufacture of it, under his successor, was carried to a far greater degree of perfection than the moderns are capable of.

It is related that, in the time of Tiberius, an artificer in Rome, made a glass vessel of so tenacious a temper, that it was as difficult to break as if it had been made of metal; and which being thrown with great violence on the ground, in the presence of the emperor, was not broken, but bruised, and was immediately beaten into its former shape, by an instrument which the artificer had ready for that purpose. The emperor, who appeared to have been rather more alarmed than pleased with the experiment, inquired of the inventor if any other person besides himself, was privy to this method of tempering glass, and rendering it malleable, and being answered in the negative, he ordered the unfortunate artificer to be put to death, saying, that if the art should become generally known, gold and silver would be of as little value as dirt.

Pliny observes, that in his time, glass was made with the sand found at the mouth of the river Vulturnus, between Cumæ and the Lucrine Bay. This sand was very fine, and, being mixed with three parts of the fossil alkali, and fused, was conveyed in a liquid state into other furnaces, where it was formed into a mass called ammonitrum, which being again melted, became pure glass, and was brought to the shape required by blowing with the breath, though some pieces were ground on a lathe, and others embossed in the same manner as gold and silver; he further notices, that no substance was more manageable in receiving colours, or being formed into shape, than glass. And it appears from Martial, that glass was not only in common use for drinking vessels, but was likewise formed into

bottles, in which wine was kept: and a regular company of glass manufacturers, was soon afterwards established, near the Porta Capena, at Rome; but the Romans, in general, preferred silver and gold, to glass, for the composition of their drinking vessels.

Some square panes of a *glazed window* were discovered at Herculaneum, which proves that the Romans made use of glass, as well as of the lapis specularis and phengitas, noticed by Seneca, for the admission of light into their rooms.

It is presumed, that the *manganese* was made use of to purify glass in the time of Pliny, as he more than once remarks, that the magnet was employed in glass; and under this name the ancients comprehended manganese, though the term itself, was first used by Albertus Magnus.

The art of manufacturing glass into such ornaments as beads and amulets, was known to the ancient Britons, long before the arrival of the Romans: they also, according to Strabo, made vessels of glass which were generally of a blue-green cast; but, as no notice is taken of this manufacture during the period of the Roman government, it was, probably, one of those arts which, being only known to the Druids, was lost on the extermination of that people by Suetonius Paulinus.

The venerable Bede informs us, that the Abbot Benedict, about the year 674, first brought from Italy artificers skilled in making of glass, for the purpose of glazing the church and monastery at Weremouth; and as St. Jerome, who wrote early in the fifth century, and Gregory of Tours, in the sixth century, make mention of windows formed of glass melted, and cast into thin plates, being used in their time, it would seem that this was one of the few arts, which, from its great utility, was able to withstand the shock of Gothic devastation; yet glass windows were but rarely used on the continent, even in the twelfth century. Among Madox's collections of the 49th Henry III., is an abstract of a roll marked Woodstock, evincing that so long ago as 1265, glass windows were used in his palace, at that place, as also at Westminster; and that Chaucer's chamber windows were glazed, we gather from his *Dreame:*—

> "My windows wherein shet echone.
> And through the glasse the sunne yshone,
> Upon my bed with bright bemis,
> With many glad gildy stremis." *l.* 333.

In a charter of Richard II., 1386, mention is made of glass, together with the manufacture of it for windows. The glass for Warwick Chapel, in the time of Henry VI., was procured from abroad, at two shillings a foot; and it seems to be the general opinion, that most of the windows in this country, were made of lattice, and not of glass, till the commencement of the sixteenth century. William Harrison, who wrote in 1577, observes, "that of old time, our countrie houses instead of glasse did use much lattice, and that made either of wicker, or fine rifts of oke in checker-wise; I read also that some of the better sort, in and before the times of the Saxons, did make panels of horne instead of glasse, and fix them in wood calmes, but as horne

in windows is *now* quite laid down in every place, so our lattices are also growne into lesse use, because glasse is nearly as cheape, if not better, than the other." But glass windows were not introduced into the better sort of farm-houses in the country, till the commencement of the seventeenth century.

The Venetians, about the commencement of the fourteenth century, became celebrated for their glass manufactories at Mureno; and from that time till the middle of the seventeenth century, they generally supplied the rest of Europe with this article. Our ancestors generally drank out of cups made either of wood, horn, or metal: cups of crystal glass were imported from Venice during the reign of James I., and were placed in recesses, as objects of value and curiosity, along with the china and plate, in the time of Charles II. A manufacture of glass was first established in London, in 1557, and was considerably improved in 1635, by the adoption of pit, or sea coal, instead of wood. Soon afterwards a monopoly was granted to Sir Robert Mansell, to import the fine Venetian flint glasses for drinking; the art of making which, was not brought to perfection before the reign of William III In 1670, the Duke of Buckingham, having procured some artists from Venice, introduced the manufacture of fine glass into England, with so much success, as, in the course of a century, to have surpassed the productions of the Venetians themselves.

The art of *casting* glass in plates, was invented by Abraham Thevant, a Frenchman, in 1688, and first practised in this country, at Prescott, in Lancashire, in 1773.

The art of tinging the glass with various *colours* was known to the ancients, and practised at Alexandria; for we read that cups manufactured at that place, were presented to the emperor Adrian, which sparkled with colours of every kind, and Strabo says this was effected by a peculiar earth which was only to be met with in Egypt. In some collections of antiquities at Rome, are pieces of glass so perfectly coloured and transparent throughout, that they were frequently taken for jewels. What materials the ancients used for colouring glass is unknown; but it is certain that metallic calces must have been employed, as these pigments alone, are capable of withstanding the heat of the glass furnaces.

The process of tinging glass and enamels, by preparations of gold, is first detailed by Neri, in his *Art of Making Glass*, published in 1611, which was improved upon by the gold calx or precipitate, invented by Kulkel, who, about the year 1680, made a cup of ruby glass for the Elector of Cologne, weighing not less than twenty-four pounds, a full inch in thickness, and of an equally beautiful colour throughout. Drinking-glasses with gilt edges, were first manufactured at Bohemia and other places in Germany.

Painting on glass and in enamel may, in certain respects, be considered as branches of the art of colouring glass: originally it consisted in the arrangement of pieces of glass of different colours, in some sort of symmetry, constituting a kind of Mosaic work; afterwards, when an attempt was made to represent figures, and to de-

lineate the different shades of their draperies, the figures were drawn in black, with water colours, and the draperies attached to it by separate glasses of the colour required. About the year 1500, a French painter at Marseilles, discovered a method of incorporating the coloured drawings themselves on the glass, by exposing it to a proper degree of heat after the colours had been laid on; and this invention was considerably improved upon, by Albert Durer, and Lucas of Leyden.

This art is supposed to have been introduced into England in the reign of John, and was at first exercised by ordinary tradesmen, from plans drawn by artists. Walpole produces instances of it in the reign of Henry III.; and he traces the history of it from the Reformation, (when misguided zeal destroyed most of the monuments of it in our churches,) through a series of professors to the present time.

The art of cutting or engraving on glass by means of the lapidary's wheel is noticed by Pliny, and was revived by Caspar Lehmann, in the beginning of the seventeenth century. The diamond is first mentioned as being applied to this purpose by Francis I. of France; soon after which, festoons and other ornaments, cut with a diamond, became extremely common on the Venetian glasses. Previous to this discovery, emery and sharp-pointed instruments of hard steel, and sometimes a red-hot iron, were used by the glaziers for the purpose of dividing the glass.

A method of forming glass to resemble *porcelain*, by reducing it to a less vitrified state, was invented by Reaumur, about 1740.

The property which glass possesses, in common with other substances, of being extended by heat and contracted by cold, was communicated by Hooke to the Royal Society, in 1660.

Musical glasses are of German origin, and were introduced into England in 1760.

[*White's History of Inventions.*

History of Bells.

Any attempt to trace the origin of bells would be useless, those of a small size being very ancient. According to the Mosaic law, the lower part of the blue robe worn by the high priest in religious ceremonies, was to be adorned with pomegranates, and gold bells, intermixed at equal distances, which it is conjectured was meant to give notice of his approach to the sanctuary, and thus escape the punishment of death, annexed to an indecent intrusion. At first, bells seem to have been appropriated to religious purposes, and were common in all the heathen temples; afterwards the Greeks and Romans used them for civil and military purposes.

Saint Paulinus, who about the year 400, was bishop of Nola, in Campania, is said to be the first who introduced bells into churches, previous to which the Christians made use of rattles, "sacra ligna,"

to call the congregation together, no bells being allowed by government to a proscribed sect; hence bells were called by the Romans, nolæ, and sometimes campanæ.

It is said that bells of a *large* size were applied to ecclesiastical purposes, in some of the monastic societies of Caledonia, so early as the sixth century: they are noticed by the venerable Bede in 670, and appear to have been common, from the first erection of parish churches in this kingdom. Ingulphus informs us that Terketulus, abbot of Croyland, who died about the year 870, gave a great bell to the church of that abbey, which he named Guthlac, and it is stated that St. Dunstan, about the year 970, cast two of the bells of Abingdon Abbey, with his own hands.

The Chinese were formerly celebrated for the magnitude of their bells: at Nankin there was one twelve feet high, seven and a half in diameter, and twenty-three feet in circumference—but this has been greatly surpassed by one made at Moscow, by order of Anne, late empress of Russia, which is stated by Mr. Cox to have been nineteen feet high, sixty-three feet eleven inches in circumference, and twenty-three inches thick, and weighing 432,000 lbs.

Brand says the custom of *muffling* bells was introduced into this country soon after the restoration; and that the use of bells in the time of mourning was formerly prohibited.

The *passing-bell*, according to Mabillon, anciently served two purposes: one of which was engaging the prayers of all good people for departing souls; and the other was, driving away the evil spirits which were supposed to haunt the bed and house, and ready to seize their prey, but kept at a distance by the ringing of this bell. Durand, in his Ritual, written about the end of the twelfth century, speaks of it as an old and well-established custom:—

> When thou dost hear a toll or knell,
> Then think upon *thy* passing-bell.

The bell of St. Sepulchre's commenced tolling for prisoners, on the morning of their execution, in 1605.

The custom of *baptizing* bells is very ancient: before bells were hung they were washed, crossed, blessed, and named by the bishop, generally after some saint, that the people might think themselves summoned to divine service by the voice of the saint whose name the bell bears: this practice was, however, prohibited by Charlemagne in 789, but was soon afterwards revived, and on the restoration of the Bourbon dynasty, the bell of the church of Notre Dame at Paris, was regularly baptized, and received the name of the Duke and Dutchess of Angouleme, on the 15th of November, 1816.

The practice of *ringing the bells in changes*, or regular peals, is said to be peculiar to the British nation—whence Britain has been termed the ringing island. This custom seems to have originated with the Anglo-Saxons. Ingulphus states, that besides the large bell before noticed, as having been given by Terketulus to Croyland Abbey, he also, some time afterwards, gave six other bells, all of which rang together, and were the first tunable bells in England;

and it is certain this diversion was common in England long before the Conquest. There are now several societies of ringers in London, particularly one known by the name of the College Youths, of which Sir Matthew Hale, lord chief-justice of the court of King's Bench, was in his younger days a member.

The uses of bells are summed up in the following Latin distich:—

> Laudo Deum verum, plebem voco, congrego clerum,
> Defunctos plero, pestem fugo, festa decoro.

The Mahometans make no use of bells, considering them as profane; but the people are summoned to the mosques by the voice of the public crier, from one of the towers, or minarets. *Ib.*

Of Animal Strength.

[From the Library of Useful Knowledge.]

Under the direction of a society established in London, '*For the diffusion of useful knowledge,*' a number of small, distinct treatises are now in the course of publication, which have for their object, a clear explanation of those branches of science, which are most intimately connected with the useful arts. Although we think that they are, upon the whole, susceptible of much improvement, by the use, in many instances, of a more familiar and popular style, the work is yet very excellent; and we shall make frequent selections from it, of such portions as we may deem most useful. Editor.

One of the most obvious, and, therefore, one of the earliest, although, perhaps, the least efficient of the prime movers, is *animal strength.*

From our ignorance of the nature and principle of animal life, it is evident that we cannot attempt to explain, on scientific principles, the laws which regulate animal strength: and, on the other hand, owing to the very fluctuating nature of this force, the various physical causes which produce differences in its manifestations in different individuals, and even in the same individual, at distances of time by no means great, considerable difficulties obstruct the investigation and development of these laws by the process of actual observation and experiment. The whole analogy of nature, the beauty, order, and singular harmony of all her works, however, convince us that this force, like every other, is regulated by fixed laws.

To simplify our investigations, we shall consider every exertion of animal strength to be represented by that which is necessary to carry a load or weight. It is not difficult to imagine, that, in whatever way strength be used, we can find a certain load carried with a certain speed, which may be considered as an equivalent exertion.

In estimating the exertion of animal strength in this way, one law is very obvious, which is, that as the load is increased (all other things being the same,) the velocity of the animal must necessarily be diminished. But, then, it becomes a more difficult matter to determine in

what proportion the velocity should be diminished with a given increase of load, in order that the expenditure of animal labour should be the same. Different formulæ have been suggested, each agreeing more or less with experience, and we shall here attempt to explain, in a popular way, that formula which seems to represent the results of experiments most accurately.

There are two extreme cases of animal exertion. There is a certain speed at which the animal can carry no load, and can barely move its own body; let this speed be called X. There is some load so great that the animal can barely sustain it, without being able to move it; call this load L. What is technically called the *useful effect* depends on two things—the *load* which is borne, and the speed or velocity with which it is carried. The useful effect is, in fact, estimated by multipling the load by the speed. This will be easily understood by an example. Suppose one horse carry two hundred weight six miles an hour, and another carry three hundred weight four miles an hour. The load of the former is two, and the speed six; the product, or useful effect, being twelve. The load of the latter is three, and the speed four; the useful effect being twelve. The propriety of considering the useful effect to be equal in these two cases, will appear very evidently, if we consider both horses to be employed in transporting weights between two places, distant one mile asunder, for six hours. The first horse will carry in the six hours, 72 hundred weight between the two places, for he will make thirty-six turns, travelling for six hours at six miles an hour, and at each turn he will carry two hundred weight. The other horse will make but twenty-four turns, since he travels only four miles an hour; but then, in each turn, he will carry three hundred weight; and therefore, he will also transport, in the given time, 72 hundred weight between the two places. Thus the useful effects of these horses are equal, and hence the propriety of estimating the useful effect, by the product of the numbers which express the load, and the speed with which that load is carried.

Recurring now to the load L, and the speed X, it is apparent that, with the load L, the useful effect is nothing, because there is no speed; and again, with the speed X, the useful effect is nothing, because there is no load. But with a load less than L, there will be a speed less than X; and, therefore, there will be a useful effect. These, then, are two limiting cases, in which the useful effect vanishes; approaching which, it diminishes; and at some point between which, it is a *maximum*. To determine where this maximum lies, it is necessary that we should know in what proportion the velocity diminishes, as the load increases.

Let l be any load less than L, and let x be the greatest speed with which this load can be carried. The useful effect will be $l \times x$; that is, the load multiplied by the speed. The rule which seems best to agree with experience is, that the load l increases in the same ratio as the square of the difference between the greatest velocity X, with which the animal can move unloaded, and the greatest velocity x with which it can move the load; that is, l increases as $(X - x)^2$.

Assuming this rule, therefore, it follows, that the useful effect is represented by the product $(X - x)^2 \times x$. This will probably be more easily understood by reducing it to an arithmetical table. Let us suppose that the number 15 represents the greatest unloaded speed, and that the square of 15, or 225, represents the greatest load which can be sustained without moving. The signification of the units which compose the number 15, will be found, by dividing the space through which the animal would move in a given time, suppose one hour, into 15 equal parts: each of these parts will be expressed by a unit of the number 15, which expresses the greatest unloaded speed; and the signification of the units of 225 will be found, by dividing the greatest load which can be sustained without moving, into 225 equal parts: one of these parts will be expressed by a unit of the number 225, which expresses the greatest load. The following table gives for each degree of speed from 1 to 15, the corresponding load, and useful effect.

Speed - -	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Load - -	225	196	169	144	121	100	81	64	49	36	25	16	9	4	1	0
Useful effect	0	196	338	432	484	500	486	448	392	324	250	176	108	52	14	0

From the inspection of this table, it appears that a much greater useful effect is to be attained, by the slower motions with heavier loads, than by the quicker motions with lighter loads. The greatest useful effect is produced by the speed 5 with the load 100; that is, with a velocity which is one-third of the greatest unloaded speed, and a load, which is four-ninths of the greatest load which can be sustained without moving. We shall find this result, whatever be the number we take, to represent the greatest speed.*

* The mathematical investigation is not difficult. Let u be the *useful effect*. Then by the empirical formula already explained we have $u = (X-x)^2 x$. Differentating this we obtain

$$\frac{du}{du} = (X-x)^2 - 2(X-x)x.$$

Supposing this $= 0$ we shall obtain the value of x, which corresponds to a maximum or minimum value of u. This gives the equation,

$$(X-x)(X-3x) = 0$$

the roots of which are

$$x = X \qquad x = \tfrac{1}{3}X.$$

For $x = X$ the load and useful effect are each $= 0$. This root, therefore, corresponds to a minimum; and for $x = \frac{1}{3}X$ $l = (X - \frac{1}{3}X)^2 = \frac{4}{9}X^2$; that is, the load corresponding to one-third of the greatest speed is $\frac{4}{9}$ of the greatest load; for $L = X^2$. That this is a *maximum* is easily shown by taking the second differential, which gives

$$\frac{d^2u}{dx^2} = -3(X-x) - (X-3x)$$
$$= -4X + 6x$$

in which, if we substitute $\frac{1}{3}X$ for x we find

$$-4X + 2X = -2X,$$

which, being negative, shows that the value $\frac{1}{3}X$ corresponds to a maximum value of u.

Thus, if the greatest unloaded speed of a horse be 15 miles an hour, and that the greatest weight which he is capable of sustaining without moving, be divided into 225 equal parts, his labour will be most advantageously employed if he be loaded with 100 of these parts, and travels at the rate of 5 miles per hour. If he be thus employed, it will be found that he will carry a greater weight through a given distance, in a given time, than under any other circumstances.

The average value of human strength, considered as a mechanical agent, has been variously estimated. Desaguliers considers that a man can raise the weight of 550 lbs. 10 feet high in a minute, and continue to do so for 6 hours. Smeaton considers that this is too high an average, and thinks that six good English labourers will be required to raise 21,141 solid feet of sea-water, to the height of four feet in four hours. In this case, they will raise very little more than six cubic feet of fresh water each, 10 feet high in a minute. The labourers, whom Smeaton supposes capable of executing this work, he considers to be equal to twice the number of ordinary men. It would, therefore, perhaps, be a fair average value of a man's work to estimate it, for a continuance, at half a hogshead of water raised through 10 feet in a minute.

The efforts of men differ with the manner in which these efforts are employed. It has been shown by Mr. R. Buchanan, that the same quantity of human labour employed in working a pump, turning a winch, ringing a bell, and rowing a boat, are as the numbers 100, 167, 227 and 248.

The most advantageous manner of applying human strength is in the act of rowing.

The most useful of quadrupeds, as a mechanical agent, is the *horse*. The relative values of the labour of a horse and man are variously stated. Some estimate them as five to one, some six to one, and some seven to one. Perhaps the medium may be nearest to the true average, and that we may generally consider six men equivalent to one horse.

The most advantageous method of using the strength of the horse, is in the act of *drawing*. The worst method in which this animal can be employed, is in *carrying* a weight up a steep hill; while, on the other hand, the peculiar disposition of the limbs of a man, renders him well-fitted for this species of labour. It has been observed, that three men climbing a hill, loaded with 100lbs. each, will ascend with greater speed than one horse carrying 300lbs.

On Various Cements.

In our first volume, we published an article under the above title, which we copied from Mr. Gill's Technical Repository. Those which we now give from an early volume of the Philosophical Magazine, were, we believe, principally supplied by the same hand. There are but few artists to whom some of the recipes will not be found of use, and many of them are applicable by every one, to the

purposes of domestic economy. We shall hereafter add to the number of similar articles, without regard to the novelty of the processes recommended, our wish being to make extensively known, what experience has proved to be really useful. EDITOR.

Cements for Derbyshire Spar and other Stones.

A cement for this purpose may be made with about seven or eight parts of rosin, and one of bees' wax, melted together, with a small quantity of plaster of Paris. If it is wished to make the cement fill up the place of any small chips that may have been lost, the quantity of plaster must be increased a little. When the ingredients are well mixed, and the whole is nearly cold, the mass should be well kneaded together. The pieces of spar that are to be joined must be heated until they will melt the cement, and then pressed together, some of the cement being previously interposed.

Melted sulphur applied to fragments of stones, previously heated (by placing them before a fire) to at least the melting point of sulphur—and then joined with the sulphur between, makes a pretty firm and durable joining.

Little deficiencies in the stone, as chips out of corners, &c. may also be filled up with melted sulphur, in which some of the powder of the stone has been mixed.—The stone must be first heated.

Temporary Cements, for Turners, &c.

Workmen are often at a loss for such a cement as will hold firmly till they have no further occasion for it, and yet, be easily parted when it is necessary; as in fixing glass plates to blocks to be ground for optical purposes, joining metallic plates to be turned in a lathe, &c. For such purposes, a cement composed of the following ingredients will be found to answer well:

To four ounces of rosin and one-fourth of an ounce of bees' wax melted together, add four ounces of whitening (washed carbonate of lime or chalk,) made previously red hot. The whitening should be put in while yet hot, that it may not have time to imbibe moisture from the atmosphere. This makes a good cement for holding optical glasses on the end of a mandril while grinding, or for similar purposes.

To cement plates of metal to the chucks of a lathe in order to turn them, the chuck should be heated, which is commonly done, by directing the flame of a candle upon it urged by a blow-pipe; the metal should also be heated in the same manner until they will melt the cement applied to them. The pieces, being then placed in contact, are adjusted centrally, while the cement cools, either by holding a pointed stick in a small hole previously made in the centre of the plate by a prick punch, or by pressing a piece of wood laterally against it. When cold, it will be held firm enough, by means of the cement, to bear being turned, and may be disengaged at any time by again heating it.

Pitch, rosin, and a very small quantity of tallow, melted together,

and thickened by stirring in dry brick dust, is employed by chasers of gold and silver articles to support and hold their work.

This mixture forms a cheap cement, useful for many purposes, as fixing small steel articles on the blocks destined to hold them for polishing, and is much used at Birmingham. The proportions of the ingredients depend on the heat of the weather, and the particular purpose in view. In winter, a larger portion of tallow is necessary, than in summer.

Shell-lac is a very strong cement for holding metals, glass, or precious stones, while cutting, turning, or grinding them. The metal, &c. should be warmed to melt it.

Bees' wax mixed with a little colcothar, (red oxide of iron,) makes a good polishing tool for lenses: use a little finely-washed colcothar mixed with water for the cutting material, applied between the tool and the lens.

Cement for Glass and China.

White of eggs, mixed up with a little quicklime, (or a bit of chalk burnt in a common fire and pounded,) makes a pretty good cement for glass and porcelain. It is not absolutely necessary that the chalk be burnt, though it is generally used so.

Gum-Arabic Cements.

Gum-arabic, dissolved in as small a quantity of water as may be, and diluted to a proper consistence with gin, or any proof spirit, forms a very useful cement for all purposes where gum-water is commonly used, the spirit preserving it from becoming putrescent. As the spirit evaporates, more should be added. It should be stirred and mixed together at the time of using.—If plaster of Paris be added to gum-water, it makes a cement useful to ladies in filligree works.

Gum-ammoniac added to the solution of gum-arabic in proof spirits very much improves the cement. It answers very well for joining broken glass and ornamental articles of porcelain.

A fine transparent Glue.

Shreds or parings of vellum or parchment, boiled for a sufficient length of time in soft water, dissolve at last into a very transparent glue. White leather, that is, skins dressed with alum instead of being tanned, will answer the same end.

Isinglass Cements.

A useful cement is made of this substance, by either dissolving it in any proof spirit by heat, or by adding to it, when dissolved in water, an equal quantity of alcohol.

An improved cement may be made by adding to the isinglass, previous to its solution in proof spirits, one-third part of its weight of gum-ammoniac. Expose the mixture to a boiling heat, until the isinglass and gum are dissolved, and until a drop of the composition becomes stiff, instantly, as it cools. It will at any future time melt

with a degree of heat little exceeding that of the human body, and, in consequence of so soon becoming stiff on cooling, forms a very valuable cement for many purposes, particularly for the very nice and delicate one of fixing on the antennæ, legs, &c. of insects in cabinets of natural history.

The easy melting of this cement is no objection to its use, in cases where the articles themselves may afterwards be exposed to moderate heat; for it owes this property only to the presence of the alcohol, which evaporates very soon after it has been applied.

When used to join broken glass or china, the pieces to be joined should be previously warmed. Immersion in hot water will give them a sufficient degree of heat. Wipe off the water before applying the cement, which may be laid on with a pencil: then press the pieces together, binding them with a string, or a bit of soft wire, if necessary.

Japanese Cement, or Rice Glue.

This elegant cement is made by mixing rice flour intimately with cold water, and then gently boiling it. It is beautifully white, and dries almost transparent. Papers pasted together by means of this cement, will sooner separate in their own substance than at the joining, which makes it extremely useful in the preparation of curious paper articles, as tea trays, ladies' dressing boxes, and other articles which require layers of paper to be cemented together. It is in every respect preferable to common paste made with wheat flour, for almost every purpose to which that article is usually applied. It answers well, in particular, for pasting into books the copies of writings taken off by copying machines on unsized silver paper.

With this composition, made with a comparatively small quantity of water, that it may have a consistence similar to plastic clay, models, busts, statues, basso-relievos, and the like, may be formed. When dry, the articles made of it are susceptible of a high polish: they are also very durable.

The Japanese make quadrille-fish of this substance, which so nearly resemble those made of mother-of-pearl, that the officers of our East Indiamen are often imposed upon.

Glue of the Laplanders.

The bows of the Laplanders are composed of two pieces of wood, glued together; one of them of birch, which is flexible, and the other of fir of the marshes, which is stiff, in order that the bow when bent may not break, and that when unbent it may not bend. When these two pieces of wood are bent, all the points of contact endeavour to disunite themselves, and to prevent this, the Laplanders employ the following cement:—They take the skins of the largest perches,* and, having dried them, moisten them in cold water, until they are so soft that they may be freed from the scales, which they throw away. They then put four or five of these skins in a rein-deer's bladder, or

* It is probable eel-skins would answer the same purpose.

they wrap them up in the soft bark of the birch-tree, in such a manner that water cannot touch them, and place them, thus covered, into a pot of boiling water, with a stone above them to keep them at the bottom. When they have boiled about an hour, they take them from the bladder, or bark, and they are then found to be soft and viscous. In this state they employ them for glueing together the two pieces of their bows, which they strongly compress and tie up until the glue is well dried. These pieces never afterwards separate.—*Transactions of the Academy of Sciences at Stockholm.*

Jewellers' Cement.

In setting precious stones, pieces are sometimes broken off by accident. In such cases, they often join the pieces so correctly, that an inexperienced eye cannot discover the stone to have been broken. They employ for this purpose a small piece of gum-mastich applied between the fragments, which are previously heated sufficiently to enable them to melt the interposed gum. They are then pressed together, to force out the redundant quantity of gum.

In the same manner cameo heads, but without any ground, made of paste (white enamel or coloured glass) are often cemented on a piece of real stone to serve them for a ground, producing the appearance of a real onyx, from which they can with difficulty be sometimes distinguished.

Backs are also cemented to stones in the same manner, to change their hue. That is, behind a transparent stone, the colour of which is wished to be altered, a thin plate of a stone of a different colour is cemented, which alters the colour of the refracted light to a mixed tint, partaking of that of both. In this case, the surfaces to be joined are previously ground as flat and true as possible. They are called *doublets*.

Turkey Cement for joining Metals, Glass, &c.

The jewellers in Turkey, who are mostly Armenians, have a curious method of ornamenting watch-cases, and similar things, with diamonds and other stones, by simply glueing them on. The stone is set in silver or gold, and the lower part of the metal made flat, or to correspond with the part to which it is to be fixed; it is then warmed gently, and the glue applied, which is so very strong, that the parts never separate. This glue, which may be applied to many purposes, as it will strongly join bits of glass or polished steel, is thus made:

Dissolve five or six bits of mastich, as large as peas, in as much spirit of wine as will suffice to render it liquid; in another vessel dissolve as much isinglass (which has been previously soaked in water till it is swollen and soft,) in French brandy or in rum, as will make two ounces, by measure, of strong glue, and add two small bits of gum-galbanum or ammoniacum, which must be rubbed or ground till they are dissolved: then mix the whole with a suffi-

cient heat; keep it in a phial, stopt, and when it is to be used, set it in hot water.—*Eton's Survey of the Turkish Empire.*

The process above described may be simplified by adding the gum-ammoniac to the isinglass, during its solution in proof spirit, and exposing the mixture to a boiling heat until it is dissolved, when the solution of mastich in alcohol may be added. The gum-ammoniac previously dissolved with the isinglass, promotes the union of the mastich with the mucilage. This cement has been tried in London, and found to answer well: it stands against moisture.

Cements which resist Moisture.

Generally speaking, all cements into the composition of which gum-lac or mastich enters, of which we have already given some, possess this property.

A cement of this kind may be made by dissolving isinglass in proof spirit, to which must afterwards be added a solution of shell-lac in alcohol.

Another cement, which will also resist moisture, may be formed by melting by heat, without water, common glue with half its weight of rosin, to which must be added some red ochre to give it body; it is particularly useful for cementing hones to their frames.

Carpenters employ a cement in framing sign-boards, &c. to stand the weather, which they make by adding to a pint of well made common glue, (made with water,) an eighth part of that quantity of boiled linseed oil, dropping it into the glue, gently, and stirring it all the time.

White lead ground up with boiled linseed oil to the consistence of paint, makes a good cement for joining broken porcelain, earthen ware, and glass articles destined to hold water, &c. After the cement is applied between the pieces, they should be pressed home to each other as close as possible; the closer the better; nor need any fears be entertained that enough of cement will not be left in the joint; for the thinnest film that can be interposed, will hold firmer than a thicker one would. The articles should remain undisturbed for two or three months, and before using them, the cement sticking on the outside of the joint should be carefully scraped off with a knife.

A Cement that hardens under Water.

Mr. Gad, in the 32nd volume of the Memoirs of the Academy of Stockholm, states, that if clay and calces (oxide) of iron, be plentifully mixed with oil, they will form a mass which will harden, even under water.

A Glue insoluble in Water.

Leather-dressers' or glovers' glue, that of fish, and that prepared with linseed oil, ceruse, and red lead, which cements pretty strongly glass, stone, and wood, still leave room to wish for one of a stronger quality.

An excellent glue may be procured from cheese. Take skim-milk cheese, free it from the rind, cut it in slices, and boil it in warm water, stirring it with a spoon until it be reduced to a strong glue, which does not incorporate with water. Then throw away the warm water, pour cold water over the glue, and knead it afterwards in warm water, subjecting it to the same process several times. Put the warm glue on a grinding stone, and knead it with quicklime until you have a good glue. When you wish to use this glue you must warm it: if it be employed cold it is not so strong, but it may also be used in that manner. This glue is insoluble in water as soon as it is dry, and it becomes so in forty-eight hours after it has been applied. It may be used for glueing wood, and for cementing marble, and broken stone, and earthenware. The joining can scarcely be discovered.

Baits also for catching fish may be made of it. Fish are very fond of it, and it resists water. Boerhaave observed that no menstruum dissolved cheese, not even aqua-regia.—*Transactions of the Academy of Sciences at Stockholm.*

A Cement that will stand against boiling Water, and even bear a considerable pressure of Steam.

In joining the flanches of iron cylinders and other parts of hydraulic, and steam, engines, great inconvenience is often experienced from the want of a durable cement.

Boiling linseed oil, litharge, red and white lead, mixed together to a proper consistence, and applied on each side of a piece of flannel, previously shaped to fit the joint, and then interposed between the pieces, before they are brought home (as the workmen term it) to their place, by the screws or other fastenings employed, make a close and durable joint.

The quantities of the ingredients may be varied without inconvenience, only taking care not to make the mass too thin with the oil. It is in many cases difficult to make, at once, a good fitting of large pieces of iron work, which renders it necessary sometimes to join and separate the pieces repeatedly, before a proper adjustment is obtained. When this is expected, the white lead ought to predominate in the mixture, as it dries much slower than the red. A workman, knowing this fact, can be at little loss in exercising his own discretion in regulating the quantities. It is safest to err on the side of the white lead, as the durability of the cement is no way injured thereby, only a longer time is required for it to dry and harden.

When the fittings will not admit easily of so thick a substance as flannel being interposed, linen may be substituted, or even paper, or thin pasteboard; the only reason for employing any thing of the kind being the convenience of handling.

This cement answers well also for joining broken stones, however large. Cisterns built of square stones, put together with this cement, will never leak or want any repairs. In this case, the stones need

not be entirely bedded in it; an inch, or even less, of the edges that are to lie next the water, need only be so treated: the rest of the joint may be filled with good lime.

Another Cement that will stand the action of boiling Water and Steam.

This cement, which is preferable even to the former, for steam-engines, is prepared as follows:

Take two ounces of sal-ammoniac, one ounce of flowers of sulphur, and 16 ounces of cast-iron filings or borings. Mix all well together by rubbing them in a mortar, and keep the powder dry.

When the cement is wanted for use, take one part of the above powder, and twenty parts of clean iron borings or filings, and blend them intimately by grinding them in a mortar. Wet the compound with water, and, when brought to a convenient consistence, apply it to the joints with a wooden, or blunt iron, spatula.

By a play of affinities, which those who are at all acquainted with chemistry will be at no loss to comprehend, a degree of action and re-action takes place among the ingredients, and between them and the iron surfaces, which at last causes the whole to unite as one mass. In fact, after a time, the mixture and the surfaces of the flanches become a species of pyrites, (containing a very large proportion of iron,) all the parts of which cohere strongly together.

Another Cement of the same kind.

Take two parts of flowers of sulphur and one part of sal-ammoniac, and mix them together, with a little water, into a stiff paste.

Take also borings or turnings of cast-iron, in the state in which they are commonly found in works where boring and turning are carried on, viz. mixed with sand, and sift them finely to get rid of the grosser particles.

When the cement is wanted for use, dissolve a portion of the above paste in urine, or in water rendered slightly acidulous, and to the solution add a quantity of the sifted borings. This mixture, spread upon or between flanches of iron pipes, or put into the interstices of other parts of iron work, will, in a little time, become as hard as a stone.

Blood Cement.

A cement often used by coppersmiths, to lay over the rivets and edges of the sheets of copper in large boilers, to serve as an additional security to the joinings, and to secure cocks, &c. from leaking, is made by mixing pounded quicklime with ox's blood. It must be applied fresh made, as it soon gets so hard as to be unfit for use.

We believe, if the properties of this cement were duly investigated, it would be found useful for many purposes to which it has never been yet applied. It is extremely cheap, and very durable.

On a Method of making Cement for Terraces; and the Use of liquid Pitch to render them impermeable to water, and secure from the Attacks of Frost. By CASIMIR PUYMAURIN.

I SHALL not speak of the nature of the different lime-cements hitherto known, as they have been fully described by various authors; I shall only observe, that a cement ought to be hard, solid, and impermeable. To obtain a hard and solid cement, it has been necessary to employ different bodies, which, by their aggregation with lime, dissolved in water, speedily absorb the superabundant moisture, and furnish to the particles of lime, diffused throughout the cement, the carbonic acid, necessary for rendering it solid, and regenerating it into calcareous earth.

Vitrified lava, natural and artificial puzzolana, the scoriæ of furnaces, pounded bricks, bone-ashes, have been the bases of all the cements hitherto made, and they have been obtained more or less solid. Cements composed in this manner have been attended with perfect success in the southern parts of Europe, little exposed to rain: they do not absorb the exterior moisture, and the frost has not power to dilate their pores, or to destroy their aggregation.

The cements of Italy, Africa, Spain, and other warm countries, unite all those qualities which can be desired by the most exact observer; but in our rainy countries, exposed to very strong frosts, cements ought to possess a more essential quality than hardness or solidity, that is to say, impermeability. Cements composed of porous bodies, cannot possess this quality: being hard, and having their greatest solidity during summer, the rains of autumn gradually penetrate to their interior parts, to reduce to powder that mass which a little before had the appearance of the greatest hardness.

The inventors of the most celebrated cements, have seen their experiments fail, because they neglected this essential quality. The interposition of a fat body was long ago employed. Pliny and Vitruvius recommend the thick part of oil, and oil itself; but these bodies employed alone, can never answer the intended purpose. Oil with the lime of cement, forms a saponaceous body, soluble in water: the thick part of oil contains a very large quantity of mucilage, which water dissolves or carries off.

To preserve the bottoms of vessels, and to render them impermeable to water, resinous bodies have been employed, and particularly liquid pitch. I have thought that my cement should be covered with boiling pitch, as this resinous body penetrates its pores and renders it impermeable to water. One inconvenience, however, appeared in the use of pitch, which is, its property of becoming soft during the heat of summer. This inconvenience I remedied by besprinkling the pitch with powder of lime: the lime combines with the pitch, and forms on the cement, an exterior stratum of new cement, resembling the famous cement of the Romans called *maltha*.

All the merit of my labour, consists merely in having first employed, for preserving cements and rendering them impermeable, a

fat body capable of penetrating them, of filling up their pores, and of being insoluble in water.

I shall here give the method which I employ for making my cement; but I must first observe, that there cannot be one general method of composing cements, unless limestone and sand were every where of the same quality. The observer, therefore, must examine the nature of the composition of the lime he employs, and particularly the purity of the sand and siliceous matters: he may then vary the doses of the materials of his cement as may be necessary.

Every method of making cement requires, in general, that the puzzolana, pounded brick, and scoriæ, be reduced to fine powder, and sifted. This precaution is necessary for cement which is not to be covered with a resinous body: its surface thereby, becomes smoother and more compact, and it is less liable to be penetrated by moisture. But this advantage is more than compensated by the fissures and cracks, occasioned by the shrinking of the cement. This shrinking does not take place, in cement made according to my method, because I employ all the matters, hard, coarsely pounded, and in fragments of the size of a grain of wheat, and often as large as peas. These fragments broken in this manner, present a great number of angles and cavities, into which the calcareous part penetrates, and thus forms a kind of connected chain, which prevents those cracks and fissures, so prejudicial to cement. The lime which I employed was made from hard and white limestone of the hill of Cazeres, in the department of the Upper Garonne: this lime dissolves with a sort of ebullition and a great heat, and, after its solution, forms a white paste without any mixture of gravelly parts: it is susceptible of swallowing, as the masons here term it, a great deal of sand and other hard matters, but it has less strength in the open air than meagre lime, which being made from marly stone, contains in its composition a great many baked and vitrified argillaceous matters, which give it great strength when exposed to the open air and to water. This lime, called in the country *chaux de Bourret*, requires little sand, because the calcined and vitrified earthy parts which it contains, form with it already an intimate mixture, or a kind of cement: this lime, therefore, dissolved in water, acquires, in a little time, the hardness of stone.

The lime I employed then was perfectly pure, without any internal mixture of heterogeneous parts, but which had no great solidity when exposed to the open air.

I found that a fifth part of lime was sufficient, to give to cement that connecting quality, necessary to envelop all the vitrified and siliceous parts of a calcareous stratum, and, consequently, to give it the greatest solidity. Such is the process I employed to form on a roof, constructed for two hundred years, the joists of which were at a great distance from each other, a terrace of forty square fathoms, which still exists, and has withstood four severe winters, and our scorching summers.

One precaution which I did not take, and which embarrassed me

a good deal, was to pound the limestone before it was employed. The stone dissolves in water; but some stones being less calcined than others, their nucleus does not dissolve, and only becomes penetrated with moisture. When these are blended with the gravel and siliceous matters employed, at the end of some days, the cement blisters, and splits into small fragments, and bits of the lime which have not been dissolved, are found in the state of lime slaked in the open air.

Take two measures of river pebbles well washed, or fragments of brick of the size of a nut; two of tiles and iron scales coarsely pounded, one of river sand perfectly well washed, and a measure of the lime of Cazeres, just from the kiln, and pounded.

Form a circle with the sand, and throw into the hollow, the lime which has been slaked, taking care to mix it thoroughly: when the lime is well diluted leave it in that state for three hours, in order that the whole lime may be dissolved; then mix with it gradually the river pebbles, the iron scales, the tiles, and the sand. This mortar must then be worked for half an hour, that every siliceous stone and fragment of tile may be well incorporated.*

Such is the manner in which I prepare cement. There are two methods of employing it; either above a pavement of brick, or below it. The former appears to be the most solid, during the first year, while the other suffers the rain water to filter through it, but at the end of a certain time it acquires the most perfect solidity.

As time destroys the timber on which the mortar is placed, when a terrace is intended to be made on a floor, it must be coarsely covered with sand and clay: when this covering is dry, another, composed of mortar and pretty fat sand, must be placed over it: there is no necessity for cutting the bricks, and the upper surface must be rough or notched with a chisel. This pavement must have an inclination sufficient to make the water run off.

In the month of July, when the two coverings are very dry, the cement composed in the above manner must be applied in bands of two feet in breadth; two workmen are sufficient. This stratum of cement ought to be from two inches and a half, to three in thickness; the covering on which it is placed, ought to be moistened with milk of quicklime; and the cement must be pressed down closely with the trowel, taking care to beat it with the sharp edge of that instrument. It is smoothed by the back of the trowel slightly moistened. The surface of the cement must be again pressed down, to bury the coarser parts and render the whole smooth. When the first band is finished, the workman proceeds to a second, and the two bands must be carefully united to prevent their separation.

This cement soon dries, and at the end of an hour can sustain a strong pressure. It must, however, be left, seven or eight days; after which the surface of it is to be slightly moistened, and then pressed

* When the cement is almost finished throw over it about a bushel of quicklime in powder. The mortar then becomes very difficult to be stirred. Or two pints of milk of lime are then to be added, which will penetrate the cement in every part.

down and smoothed by means of flat stones, in the same manner as marble is polished. This last precaution is essentially necessary, and the solidity of the cement will depend on the care with which it has been performed. When the terrace has been constructed in this manner, the aggregation of the cement becomes stronger, and its pores are smaller and less numerous.

In order that the cement may succeed perfectly, it must be made during the great heats of July, that the superabundant water may evaporate, and that it may be perfectly dry before the autumnal rains. At the end of August, boil pitch, such as that used for ships, and spread it over the cement by means of large brushes. As this coating would render the cement not fit to be touched during summer, this inconvenience may be remedied in the following manner:—Take lime, slaked in the open air and reduced to fine powder, and, having sprinkled it over the pitch, remove, by means of a broom, the superfluous part of the lime which does not adhere to it. This lime, by combining with the pitch, will form with it a very thin stratum of cement, similar to the maltha of the Romans. At the beginning of October a second stratum of pitch and lime must be laid on.

The second method of employing the cement is to place it immediately over the stratum of brick and clay, and then to cover it with a pavement of brick, mortar, and sand. I have two terraces, fifteen fathoms in length, and one and a half in breadth, which appear to me to have the greatest solidity. They are not so beautiful as those where the cement covers the brick; but they can stand every kind of friction or pressure.

After making a stratum of clay and sand, spread over it a stratum of cement four inches in thickness, well beaten, and add pebbles somewhat larger than those employed in the preceding cement, and increase the dose of lime in proportion: the cement must then be beaten with clubs like those used for smoothing the walks in the neighbourhood of Paris. It is then to be left to dry for a month, after which the surface of it must be moistened with milk of lime; and the bricks are to be placed with good lime and sand.

It is not necessary that these bricks should be ground. I have observed that, by cutting, their strength is lessened, as it destroys their upper, half vitrified surface: nothing then remains below but an earthy surface, which is soon penetrated by moisture, and which is easily destroyed by frost. Care must be taken to fill up the joints with good mortar, which must be pressed in and smoothed by the trowel, and then pitched.

Terraces constructed in this manner, suffer the water for some time to filter through them in small quantity. This water charged with calcareous particles, stops up the pores of the cement; no more filtration takes place: and terraces of this kind have the greatest solidity, and are exceedingly cheap. This cement may be employed with advantage for the interior of apartments; it also may supply the place of pavements of cut bricks, and costs two-thirds less.

It must be spread over a pavement of rough bricks, or bricks

picked with an instrument, to the thickness of an inch or nine lines. The pebbles may be omitted, and their place supplied by fragments of tiles and iron scales, coarsely pounded: it is then to be pressed down and smoothed with flat stones, but before it is painted it must be suffered to dry for a month. It is painted and waxed in the same manner as brick pavement.

Such are the details of the cement I have employed, and which has been attended with complete success. But I shall here repeat, that the doses must be varied according to the greater or less purity of the lime and of the other matters employed; and the application of pitch is merely to prevent the infiltration of water, and the destruction of the cement by frost.

ACTIVE AND PASSIVE STRENGTH.

Active Strength, or Animal Energy, as of Men, Horses, &c.

[From Gregory's Mathematics for Practical Men.]

1. The force obtained through the medium of animal agency, evidently varies, not only in different species of animals, but, also, in different individuals. And this variation depends, first, on the particular constitution of the individual, and upon the complication of causes, which may influence it; secondly, upon the particular dexterity acquired by habit. It is plain, that such a variation cannot be subjected to any law, and that there is no expedient to which we can have recourse, but that of seeking mean results.

Secondly, the force varies according to the nature of the labour. Different muscles are brought into action, in different gestures and positions of an animal which labours; the weight itself, of the animal machine, is an aid in some kinds of labour, and a disadvantage in others: whence it is not surprising, that the force exerted, is different, in different kinds of work. Thus the force exerted by a man is different, in carrying a weight, in drawing, or pushing it horizontally, and in drawing, or pushing it vertically.

Thirdly, the force varies according to the duration of the labour. The force, for example, which man can exert in an effort of a few instants, is different from that, which he can maintain equably, in a course of action continued, or interrupted only by short intervals, for a whole day of labour, without inducing excessive fatigue. The former of these, may be called *Absolute Force*, the latter *Permanent Force*. It is of use to become acquainted with them both, as it is often advantageous, to avail ourselves sometimes of the one, sometimes of the other.

Lastly, the force varies according to the different degrees of velocity, with which the animal, in the act of labouring, moves either its whole body, or that part of it which operates. The force of the animal is the greatest, when it stands still; and becomes weaker as it moves forward, in proportion to its speed; the animal acquiring, at

last, such a degree of velocity, as renders it incapable of exerting any force.

2. Let ϕ be a weight equivalent to the force, which a man can exert, standing still; and let v be the velocity with which, if he proceeds, he is no longer capable of exerting any force: also, let F be a weight equivalent to the force which he exerts, when he proceeds, equably, with a velocity v.

Then F will be a function of v, such that, 1st, it decreases, whilst v increases; 2ndly, when $v = 0$, then $F = \phi$; 3dly, when $v = v$, $F = 0$.

3. Upon the nature of this function, we have the three following suppositions:

1. $F = \phi . \left(1 - \frac{v}{v}\right)$. (Bouguer, *Man. des Vais.*)

2. $F = \phi . \left(1 - \frac{v^2}{v^2}\right)$. (Euler, *Nov. Comm. Pet.* tom. III.)

3. $F = \phi . \left(1 - \frac{v}{v}\right)^2$ (Ib. tom. VIII; and *Act. of Rowers.*)

4. *Coroll.* 1. The effect of the permanent force, being measured by the product $F\,v$, the expression for the effect will be one of the three following, accordingly as one or other of the suppositions is adopted.

1. $F\,v . \left(1 - \frac{F}{\phi}\right)$, or $\phi\, v \left(1 - \frac{v}{v}\right)$.

2. $F\,v . \sqrt{\left(1 - \frac{F}{\phi}\right)}$, or $\phi\, v \left(1 - \frac{v^2}{v^2}\right)$.

3. $F\,v . \left(1 - \sqrt{\frac{F}{\phi}}\right)$, or $\phi\, v \left(1 - \frac{v}{v}\right)^2$.

5. *Coroll.* 2. To know the weight, with which a man should be loaded, or the velocity, with which he ought to move, in order to produce the greatest effect, we must make $d . Fv = 0$.

Whence we shall have.

1. $F = \frac{1}{2}\phi$; and $v = \frac{1}{2}$ v.

2. $F = \frac{2}{3}\phi$; and $v = \frac{1}{\sqrt{3}} \cdot v = 0.5773$ v.

3. $F = \frac{4}{9}\phi$; and $v = \frac{1}{3}$ v.

6. *Coroll.* 3. And the value of the greatest effect will be, according to the 1st hypothesis..... $= \frac{1}{4}\phi$ v:

..... 2nd..... $= \frac{2}{3\sqrt{3}}\phi$ v $= 0.3836\,\phi$ v:

..... 3d..... $= \frac{4}{27}\phi$ v.

But which of the three suppositions ought we to prefer? And are we certain that either of them approximates to the true law of nature?

M. Schulze made a series of experiments with a view to the determination of this point,* and with regard to men, decided in favour of the last of Euler's formulæ:

$$\text{viz. } f = \varphi\left(1 - \frac{v}{v}\right)^2.$$

As the experiments of this philosopher are very little known in England, I shall here present his brief account of them.

7. To make the experiments on human strength, he took at random, 20 men of different sizes and constitutions, whom he measured and weighed. The result is exhibited in the following table.

Order.	Height.	Weight.	Order.	Height.	Weight.
1	5′ 3″ 4‴	122	11	5′ 9″ 7‴	132
2	5 2 3	134	12	5 1 4	157
3	5 7 2	165	13	5 3 2	175
4	5 5 0	131	14	5 4 1	117
5	5 11 2	177	15	5 10 8	192
6	6 0 4	158	16	5 0 3	133
7	5 8 3	180	17	4 11 2	147
8	5 2 1	117	18	5 3 9	124
9	5 4 8	140	19	5 6 0	163
10	5 0 4	126	20	5 10 1	181

Here the heights are expressed in feet, (marked ′) inches, (″) twelfths, (‴) the feet being those of Rhinland, each 12.35 English inches. The weights are in pounds, which are to our avoirdupois lbs. as 30 to 29.

To find the strength that each of these men might exert to raise a weight vertically, Mr. Schulze made the following experiments:

He took various weights, increasing by 10 lbs., from 150 lbs. up to 260 lbs.; all these weights were of lead, having circular and equal bases. To use them with success, in the proposed experiments, he had at the same time a kind of bench made, in the middle of which, was a hole of the same size of the base of the weights: this hole was shut by a circular cover when pressed against the bench; at other times it was kept at about the distance of a foot and a half above the bench, by means of a spring and some iron bars. To prevent the weight with which this cover was loaded, during the experiment, from forcing down the cover, lower than the level of the surface of the bench, he had several grooves made in the four iron bars, which sustained the cover, and which at the same time, served to hold up the cover, at any height where it might arrive by the pressure of the springs, as soon as the pressure of the weight ceased.

* Mem. Acad. Scienc. Berlin, for 1783.

After having laid the 150 lbs. weight on the cover, and the other weights in succession, increasing by 10 lbs., up to 250 lbs., he made the following experiments with the men whose size and weight are given above, by making them lift up the weights as vertically as possible, all at once, and by observing the height to which they were able to lift them. The annexed table gives the heights observed for the different weights marked at its head.

	150		160		170		180		190		200		210		220		230		240		250
	″	‴	″	‴	″	‴	″	‴	″	‴	″	‴	″	‴							
1	7	9	6	4	4	11	4	4	3	8	2	8	1	1							
2	7	10	6	6	5	7	4	7	3	11	2	5	0	5	″	‴	″	‴			
3	7	9	7	3	6	5	5	9	4	11	4	0	3	0	1	7	0	3	″	‴	
4	8	3	7	6	7	2	5	10	5	3	4	7	4	0	3	8	3	1	1	4	
5	12	4	11	1	9	7	8	5	7	10	7	1	5	10	4	7	3	2	1	3	
6	14	5	14	0	13	5	12	8	11	5	10	1	8	6	6	6	4	1	0	1	
7	12	11	11	3	10	5	9	3	8	1	6	9	5	3	3	8	1	11	0	2	
8	11	9	10	2	9	4	8	11	8	1	6	11	5	10	5	1	3	2	1	0	
9	9	5	8	3	7	1	5	6	4	1	2	9	1	3							
10	8	1	6	5	4	7	3	9	2	5	1	7	0	4							

This table proves that the size of the men employed to raise the weights vertically, has considerable influence on the height to which they brought the same weight. We find, also, that the height diminishes in a much more considerable ratio, than the weight increases: and we may therefore conclude, that it is advantageous to employ large men when it becomes necessary to draw, vertically, from below upwards: and on the contrary, it is more advantageous to employ men of a considerable *weight*, when it is required to lift up loads by means of a pulley, about which a cord passes, that the workmen draw in a vertical direction, from above downwards. To find the absolute strength of these men, in a horizontal direction, Mr. Schulze proceeded thus:

Having fixed over an open pit, a brass pulley extremely well made, of 15 inches diameter, whose axis, made of well polished steel to diminish the friction, was $\frac{3}{4}$ inch in diameter; he passed over this pulley a silk cord, worked with care, to give it both the necessary strength and flexibility. One of the ends of this cord carried a hook to hang a weight to it, which hung vertically in the pit, whilst the other end was held by one of the 20 men, who, in the first order of the following experiments, made it pass above his shoulders; instead of which, in the second, he simply held it by his hands.

Mr. S. had taken the precaution to construct this in such a manner, that the pulley might be raised or lowered at pleasure, in order to keep the end of the cord, held by the man, always in a horizontal direction, according as the man was tall or short, and exerted his strength in any given direction.

He had made the necessary arrangements, so as to be able to load, successively, the basin of a balance, which was attached to the hook at the end of the cord, which descended into the pit, whilst the man who held the other end of this cord, employed all his strength without advancing or receding a single inch.

The following table, gives the weights placed in the basin when the workmen were obliged to give up, having no longer sufficient strength to sustain the pressure occasioned by the weight. To proceed with certainty, Mr. S. increased the weight each time, by five pounds, beginning from 60, and took the precaution to make this augmentation in equal intervals of time; having always precisely a space of 10 seconds between them. The result of these observations repeated several days in succession, is contained in the following tables.

I. When the cord passed over the shoulders of the workmen.

Order.	lbs.	Order.	lbs.	Order.	lbs.	Order.	lbs.
1	95	6	100	11	95	16	95
2	105	7	115	12	100	17	100
3	110	8	105	13	110	18	90
4	100	9	95	14	90	19	100
5	105	10	90	15	110	20	100

II. When the cord was simply held before the man:

Order.	lbs.	Order.	lbs.	Order.	lbs.	Order.	lbs.
1	90	6	100	11	90	16	90
2	105	7	110	12	90	17	90
3	105	8	100	13	100	18	85
4	90	9	90	14	85	19	100
5	95	10	85	15	105	20	100

These two tables show, that men have less power in drawing a cord before them, than when they make it pass over their shoulders; they show, also, that the largest men have not always the greatest strength to hold, or to draw in a horizontal direction, by means of a cord. To obtain the absolute velocity of these 20 men, Mr. S. proceeded as follows:

Having measured very exactly a distance of 12000 Rhinland feet in a plain nearly level, he caused these 20 men to march with a fair pace, but without running, and so as to continue during the period of four or five hours; the following is the time employed in describing this space, with the velocity resulting for each of them.

Order.	Time.	Veloc.	Order.	Time.	Veloc.	Order.	Time.	Veloc.
1	40.18	4.94	8	40. 9	4.99	15	36.17	5.51
2	41.12	4.85	9	40.20	4.96	16	41.28	4.82
3	39. 8	5.55	10	40.51	4.90	17	42.25	4.71
4	39.40	5.04	11	36.17	5.51	18	40.19	4.98
5	34.19	5.83	12	38.11	5.24	19	39.57	5.01
6	35.11	5.68	13	38. 5	5.25	20	37.51	5.29
7	38. 7	5.25	14	37. 1	5.40			

It is necessary to mention, with regard to these experiments, that Mr. Schulze took care to place at certain distances, persons in whom he could place confidence, in order to observe whether these men marched uniformly, and sufficiently quick, without running.

Having thus obtained, not only the absolute force, but the absolute velocity also, of several men, he took the following method to determine their relative force.

He made use of a machine, composed of two large cylinders of very hard marble, which turned round a vertical cylinder of wood, and moved by a horse, which described in his march a circle of 10 Rhinland feet. This machine appeared the most proper to make the subsequent experiments, which serve to determine the relative strength that the men had employed to move this machine, and which is used hereafter, to determine which of Euler's two formulæ ought to be preferred.

To obtain this relative force, he took here the same pulley which served in the preceding experiments, by applying a cord to the vertical cylinder of wood, and attaching to the other end of this cord, which entered into an open pit, a sufficient weight to give, successively, to the machine different velocities.

Having applied in this manner, a weight of 215 lbs., the machine acquired a motion, which after being reduced to a uniform velocity, taking into account the acceleration of the weight, of the friction, and of the stiffness of the cord, gave 2.41 feet velocity; and having applied in the same manner a weight of 220 lbs., the resulting uniform motion gave a velocity of 2.47 feet. These two limits are mentioned because they serve as a comparison with what immediately follows: Mr. S. began these experiments with a weight of 100 lbs., and increased it by 5 every time, from that number up to 400 lbs.

He made this machine move by the seven first of his workmen, placing them in such a way, that their direction remained almost always perpendicular to the arm on which was attached the cord, which passed over their shoulders, in an almost horizontal direction.

Thus situated, they made 281 turns with this machine, in two hours, which gave for their relative velocity $v = 2.45$ feet per second. We have also the absolute force, or φ, from these 7 men, by the above table = 730 lbs.: and their absolute velocity, or $v = 5.30$ feet.

Therefore, by substituting these values in the first formula, we find the relative force F = 205 lbs., which agrees very well with what we have just found above.

If instead of this first formula, the second be taken, it gives F = 153 lbs., which is far too little.

By this it is evident, that the last of Euler's two formulæ is to be preferred in all respects. Mr. Schulze made a great number of combinations, and almost always found the same effect.

Dividing the 205 lbs. which we have just found, by 7, the number of workmen, we get 29 lbs. for the relative force, with 2.45 feet relative velocity for each man, which is rather more than the values commonly adopted in the computation of machinery. A number of other observations on different machines, have given the same result; that is to say, we must value the mean human strength, at 29 or 30 lbs., with a velocity of 2½ feet per second.

To obtain the ratio of the strength of a horse to that of a man, Mr. Schulze proceeded in a similar manner; but his results, in reference to that inquiry, are neither so correct nor so interesting.

[TO BE CONTINUED.]

On the Bluing of Steel.

Iron and steel articles, when their surfaces are polished, whether simply by the file or from friction with emery, putty of tin, &c. are susceptible of receiving a blue colour from the action of heat; and which is rendered more beautiful, or deeper, in proportion as the surface is more perfectly polished, or the operation more carefully performed.

Every worker in iron and steel supposes himself to be capable of properly bluing the articles which he has made; but very few of them succeed well in it. There are some workmen, however, who, by great experience, excel in this branch, which may be considered as an art of itself. Clock and watch-spring manufacturers, and more particularly the makers of watch-springs, succeed very well; but the manufacturers of the steel hands for watches, have attained the highest point of perfection in it.

By means of heat, steel is made to receive a series of iris colours in the following order; viz. straw-colour, orange, red, pigeon's breast, violet, blue, and gray. Iron will receive the same colours, but is not susceptible of taking so vivid a tint as steel. When steel has been hardened, it must be tempered before it can be finished; and it must be softened more or less, according as it is necessary for the article to possess a greater or lesser degree of hardness in use. In some cases, it is not necessary to give an equal colour the whole length of the article, as the colour is frequently removed in the successive operations. It is nevertheless advantageous, however, that it should be as equal as possible, in order that the degree of hardness may be uniform throughout. It is a very different case when

the articles are finished and well polished, and are intended to remain blue; such, for instance, as the hands of a clock or watch: as then, if the blue is not perfectly equal, and very deep, it presents a disagreeable appearance. The following method appears to us to be the most advantageous; and we have seen it practised by the workmen in Geneva, and other parts of Switzerland, who excel in this art; it has also been successfully employed by many workmen in Paris. In a kind of stove made of sheet iron, they place turfs made of tanners' bark, or merely tan-dust: these are covered with lighted charcoal-dust. The fire soon communicates to the turfs, or tan-dust: when these begin to burn, they place the pieces intended to be blued, upon them, taking care that the ashes do not cover them, in order that they may see the colour which they assume. It is requisite to be very careful that the heat be uniform, and that it be retained at exactly the same degree, without being too great; as, in that case the operation would fail entirely, and the blue colour soon disappear and turn to a gray; the article would lose its hardness, it must be hardened afresh, and there would be a very great chance of its being overheated. In order to avoid these inconveniences, we should prefer a fire less active, and operate by degrees. When the well-polished steel has acquired a red colour, and it is seen that this colour is not perfectly uniform, the greatest heat must be directed towards the part where the colour is less intense, by blowing with the mouth that part of the fire adjacent to it. By this means, and with great care and patience, a beautifully uniform and deep blue colour is obtained.

When the article has become of a red colour, if it is found to be clouded with various shades, it is better to suspend the operation, and polish the article afresh, either with emery, tripoli, crocus-martis, putty of tin, &c. and entirely to begin anew; rather than expose the article to too great softening. We can only here point out general rules; there exists in every art, a kind of dexterity, which practice alone can give.

When the article has acquired the desired colour, it is withdrawn from the fire, and allowed to cool slowly, when it must be wiped with a clean, dry, linen cloth. Particular care is required not to touch the articles when finished, with greasy, or damp fingers; but above all, not to dip them in oil, as they would become dull, and lose that lustre in which consists all their beauty. This blue colour remains for a long time: nevertheless it is subject to change; in which case, it may be restored to all its freshness, by being polished anew, and again submitted to the same operation.

Iron never takes so fine a blue as steel; as it does not receive so good a polish, neither is it so hard; and it is probable that the carbon contained in the steel, has some influence on this operation. L.

[*Dictionnaire Technologique.*

Observations on Sheep and Wool.

The "Bulletin des Sciences Agricoles," for July, 1827, contains a review of a German Work on Sheep and Wool, by J. C. Ribbe,

published at Prague, Bohemia, from which we have translated the following, save what is enclosed in brackets.

The author adopts the opinion of Linnæus, that all the different kinds of sheep which exist are derived from a common stock, the *Ovis Argalis* [or the wild sheep which inhabit the rocky mountains of Asia and Greece.] The largest species of sheep in Europe is the breed of Flanders, which the Dutch imported from India, about two centuries ago. The smallest race is that of Scotland.—[M. Ribbe refers to the Hebridean sheep—a small breed, which weigh from 4 to 5 pounds per quarter, when fat, and yield about one pound of wool of various colours. These small animals frequently carry 4 or 5 horns. This breed was imported into Scotland from Denmark at a very early period. There is now a race in Denmark which have four horns.] The national sheep of Hungary have, in both sexes, strait horns, from 12 to 15 inches long. The wool is five or six inches in length, and so coarse, that it is fit for nothing but blankets.

Iceland has two sorts of sheep, one large, the other small. Their wool is brown, and the inhabitants do not shear it, but pull it off—a most cruel operation. The Icelanders make great use of sheep's milk. These animals live all the year exposed to the severity of the weather, and their principal food in winter is the moss called Iceland moss, which they obtain under the snow. The small species live among the steep rocks on the mountains, and sometimes a flock is carried over a precipice into a gulf, by an avalanche, where they remain until the warmth of their bodies melts the snow which covers them, and announces to their owners, by the steam which ascends, the place into which they have been carried.

In the Crimea, and some countries near the Caspian sea, they have sheep that bear, when young, short, curled wool, of a blue, brown, or black colour, which is an object of commerce. That the wool may remain in small curls, the Tartars cover the lambs with a linen cloth sewed close around them, which is not taken off until the animal is killed.—[These lambskins are celebrated, being damasked, as it were, by clothing the little animal.] In some of the vast forests of Russia there are sheep which live in a wild state; these animals are so much affected by the sounds of drums and trumpets that they begin to run, leap and dance, as soon as they hear them; and they continue these motions until, overcome by excitement and fatigue, they are no longer able to flee from their enemies.

[The largest breed of sheep in the world, is the fat tailed variety; it is raised in central Asia, China, Persia, Africa, &c. The tail is a mass of fat, and often weighs 30 pounds. Another variety of Asia, is the long tailed breed, with coarse wool; its tail sometimes drags on the ground.]

Europe did not possess any fine wooled sheep until the twelfth century. The Roman writers mention that fine wools and stuffs were imported from Spain, but this only proves that the Spanish sheep were better than those of the rest of Europe. In the twelfth century some African merchants sent to Cadiz a few sheep, the

wool of which was remarkable for its fineness and whiteness. They were purchased by a Cadiz merchant, and placed on his country estate, where they succeeded, but he found no imitators.

About the year 1350, Peter, king of Castile, having been informed that there was a race of sheep in Barbary which had precious fleeces, sent several persons into Morocco to buy a great number of bucks. From this epoch commenced the reputation of the wool of Castile. In the 16th century, when Cardinal Ximenes was the Spanish minister, complaints were made to him that the sheep of Castile had deteriorated. To remedy the evil, this minister determined to import a great number from Barbary; but as he could not obtain them by means of negociation, he kindled a war, and invaded Morocco. The Spanish soldiers had orders to bring away as many sheep as they could; they pillaged the country, and returned to Spain with the precious plunder.

The principal breeds of Spain are those which the monks of the Escurial possess; those of the convents of Guadaloupe and of Paular; those of the duke d'Infantado, and of the counts of Negretti and Montareo. The sheep of the Escurial have the most beautiful wool, those of Guadaloupe are celebrated for their form and fleece; those of Paular have their head covered with wool, and their neck full of wrinkles; those of Infantado are born with coarse wool, which afterwards becomes very fine; and those of Negretti have a strong and robust body, with fine wool. All these races are called merinoes, and were formerly the travelling flocks of Spain; since the late wars, they have become stationary. All the fine races of sheep now in Europe were derived from the merinoes of Spain.

[*Hampshire Gazette.*

The Rumford Premium of the American Academy.

From the Boston Journal of Science, for 1824, we copy the account of the donation of Count Rumford, and the purposes of the gift. Upwards of thirty years have elapsed, yet the prize has never been awarded to any one, and the interest of the fund now amounts biennally, to upwards of two thousand dollars. Is the existence of the premium nearly unknown, or have thirty years passed, without any important discovery, or useful improvement having been made on heat or light, in the American continent, or islands? We really think, that were the Count now alive, he would be able to designate persons fully entitled to the reward. Editor.

In the year 1796, Count Rumford, then residing in London, presented to the American Academy of Arts and Sciences, five thousand dollars, in 3 per cent. stock, for the purpose of establishing a biennial premium to be awarded to the author of the most important discovery, or most useful improvement on heat or light, which should be made in any part of America. The following letter addressed to the President of the Academy accompanied the donation, and con-

tains an account of the views of the liberal donor, and of the terms upon which the premium was to be awarded.

To the Hon. John Adams, President of the American Academy of Arts and Sciences.

Sir,—Desirous of contributing efficaciously to the advancement of a branch of science which has long employed my attention, and which appears to me to be of the highest importance to mankind; and wishing at the same time, to leave a lasting testimony of my respect for the American Academy of Arts and Sciences, I take the liberty to request that the Academy would do me the honour to accept of five thousand dollars, three per cent. stock, in the funds of the United States of North America, which stock I have actually purchased, and which I beg leave to transfer to the Fellows of the Academy, to the end that the interest of the same may be by them, and by their successors, received from time to time, for ever, and the amount of the same applied and given, once every second year, as a premium, to the author of the most important discovery, or useful improvement, which shall be made and published by printing, or in any way made known to the public, in any part of the continent of America, or in any of the American Islands, during the preceding two years, on heat, or on light; the preference always being given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind.

With regard to the formalities to be observed by the Academy in their decisions upon the comparative merits of those discoveries, which, in the opinion of the Academy, may entitle their authors to be considered as competitors for this biennial premium, the Academy will be pleased to adopt such regulations, as they, in their wisdom, may judge to be proper and necessary. But in regard to the form, in which this premium is conferred, I take the liberty to request that it may always be given in two medals, struck in the same die, the one of gold, and the other of silver, and of such dimensions, that both of them together may be just equal in intrinsic value, to the amount of the interest of the aforesaid five thousand dollars stock, during two years: that is to say, that they may together be of the value of three hundred dollars.

The Academy will be pleased to order such device or inscription to be engraved on the die, they shall cause to be prepared for striking these medals, as they may judge proper.

If during any term of two years, reckoning from the last adjudication, or from the last period for the adjudication of this premium by the Academy, no new discovery or improvement should be made, in any part of America, relative to either of the subjects in question, (heat, or light,) which in the opinion of the Academy, shall be of sufficient importance to deserve this premium; in that case, it is my desire that the premium may not be given, but that the value of it may be reserved, and being laid out in the purchase of additional

stock in the American funds, may be employed to augment the capital of this premium; and that the interest of the sums by which the capital may from time to time be so augmented, may regularly be given in money, with the two medals, and as an addition to the original premium, at each succeeding adjudication of it. And it is further my particular request, that those additions to the value of the premium, arising from its occasional non-adjudications, may be suffered to increase without limitation.

With the highest respect for the American Academy of Arts and Sciences, and the most earnest wishes for their success in their labours for the good of mankind,

I have the honour to be, with much esteem and regard, sir,

Your most obedient, humble servant,

RUMFORD.

London, July 12th, 1796.

Upon the receipt of the donation, the thanks of the Society were presented to Count Rumford in the following terms:

Voted, That the thanks of the Academy be presented to Count Rumford, for this his very generous donation, and that they experience the highest satisfaction in receiving this additional and very liberal aid, for the encouragement and extension of those interesting branches of science, which he has specified as the objects of his gratuity, and which *he* has so successfully cultivated: That they entertain a high sense of the sentiments and views, so becoming a philosopher, which have prompted him to this distinguished act of liberality; and in the execution of the grateful office, which they have undertaken, of awarding and distributing the premium which Count Rumford has thus appropriated, they will sacredly comply with the conditions of the donation; indulging the hope, that he will meet his reward, in learning that many in his native country are thereby excited to emulate his labours, and to promote the accomplishment of his beneficent wishes, for the advancement of science, and the augmentation of human happiness.

At a meeting held in May 1801, the Society voted, that they would, at their meeting in May of the next year, and afterwards, biennially at their May meeting, decide upon the discovery or improvement which appeared to deserve the Rumford premium. The subject, we believe, has frequently been brought before the Society, and they have been ready at the appointed time, to confer the premium upon any individual, whose claims were sufficient to authorize it. No discovery, however, or improvement, has yet been made, which has been deemed worthy this honour, and the fund has of course been accumulating, according to the terms of the donation, ever since it has been in the hands of the Society.

At the present time, the fund amounts to $7361 19, in 6 per cent., and $7050 in 7 per cent. stocks. The premium awarded, would, therefore, be the interest of these sums for two years; three hundred dollars in the form of a silver and a gold medal, and the residue in

money. This we believe is one of the largest premiums offered by any society or institution, for discoveries in science, or improvements in the arts, and is well worthy the attention of the scientific and ingenious men of our country.

The next meeting of the Society, will be held on Tuesday the 25th of May next, at their room in the Boston Atheneum. At this meeting the Society will be ready to decide upon any claims which may be offered, for the premium in question; it being the regular biennial period, at which, by their vote of 1801, this subject comes before them.

Instances of Longevity in Modern times.

That instances of longevity are not so rare in modern times as is usually imagined, the subjoined list, collected from various sources, is a curious proof, to which I beg you may give a place, if you think it will afford any amusement to your numerous readers. That I might not swell it to an inconvenient length, none have been inserted who have not attained the 130th year, or whose longevity has not appeared to be well attested. Many more might, without doubt, be added, by those who have better opportunities for collecting such accounts. The date affixed to each name is the year in which each person died, when that has been ascertained; or when not, the latest year in which each is known to have lived.

Year.	Age.	Year.	Age.
1795 David Cameron	130	1772 Mrs. Clum	138
1766 John de la Somel	130	1766 Thomas Dobson	139
1766 George King	130	1785 Mary Cameron	139
1767 John Taylor	130	1752 William Laland	140
1774 William Beatie	130	—— Countess Desmond	140
1778 John Watson	130	1770 James Sands	140
1780 Robert Macbride	130	1773 Swarling, a monk	142
1780 William Ellis	130	1773 Charles M'Findlay	143
1764 Elizabeth Taylor	131	1757 John Effingham	144
1775 Peter Garden	131	1782 Evan Williams	145
1761 Eliz. Merchant	133	1766 Thomas Winsloe	146
1772 Mrs. Keith	134	1772 J. C. Drahakenberg	146
1767 Francis Agne	134	1652 William Mead	148
1777 John Brookey	134	1768 Francis Consir	150
1744 Jane Harrison	135	1542 Thomas Newman	152
1759 James Sheile	136	1635 Thomas Parr	152
1768 Catherine Noon	136	1656 James Bowles	152
1771 Margaret Forster	136	—— Henry West	162
1776 John Moriat	136	1648 Thomas Damme	154
1772 —— Richardson	137	1762 A Polish peasant	157
1793 —— Robertson	137	1797 Joseph Surrington	160
1757 Wm. Sharpley	138	1668 Wm. Edwards	168
1768 John M'Donough	138	1670 Henry Jenkins	169
1770 —— Fairbrother	138	1782 Louisa Truxo	175

To these may be added, a Mulatto man, who died in 1797, in Frederick Town, North America, and who was said to be 180 years old.

In *The County Chronicle*, of December 13, 1791, a paragraph was inserted, which stated, that Thomas Carn, according to the parish register of St. Leonard, Shoreditch, died the 28th of January, 1588, aged 207; but this is an instance of longevity, so far exceeding any other on record, that one is disposed to suspect some mistake either in the register or in the extract.

AMERICAN PATENTS.

List of Patents granted in the United States, from June 1st, to August 22nd, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

Improvement in riding, wheel, carriages; William and Josiah Jessop, Guilford County, N. C., June 1.

In the construction of cast-iron foot-stoves; George W. Robinson, New York, June 2.

In the saw mill; Anthony Bencine, Milton, Caswell County, N. C., June 4.

In the machine for nets to pine-apple cheese; Lewis Mills Norton, Litchfield, Conn., June 4.

In the grist mill for grinding grain, with the periphery of the stone; Robert S. Thomas, of Rockingham, Richmond County, N. C., June 4.

In the cotton or hay press; Thomas D. Wilson, Corydon, Harrison County, Indiana, June 6.

In the water-wheel; Thomas D. Wilson, Corydon, Harrison County, Indiana, June 7.

In the machine for churning butter; Nathan Whitney, Augusta, Maine, June 7.

In the mode of letting the water on water-wheels; Jacob Ammon of Rockingham County, Virginia, June 8.

In constructing culinary fixtures for anthracite coal; Jacob F. Walter, Philadelphia, June 8.

In an apparatus for spinning wool and cotton, &c.; William Church, Birmingham, England, June 11.

In the bellows; Jesse Dixon, Pittsborough, Chatham County, N C., June 11.

In the grist mill, patented by Moses Mendenhall, October 20, 1826; Samuel Lawing and James Monteith, Statesville, Iredell County, N. C., June 11.

In a machine for preparing mortar, and grinding apples for cider, &c.; Thomas Streeter and James Wibirt, of Chili, Monroe, New York, June 12.

In the machine for boring earth; John R. Failing, Canajoharie, Montgomery County, New York, June 13.

In stills; Malcolm M'Gregor, of New York, June 15.

In the steam engine; John Maynard, of Ovid, New York, June 15.

In the grist mill; William W. Forwood, of Hartford County, Md. June 15.

In the mill for grinding corn and other grain, called the sugar-loaf mill; Sidney Moore and Portius Moore, of Mount Irzah, Person County, N. C., June 15.

In the discovery of a certain composition of matter, whereby scagliola is rendered more shining, vivid, and beautiful; Salvadore Pinistri, of New York, June 18.

In the cork cutter; Luther Hills, of Boston, June 18.

In the boot crimping, or boot blocking machine; Samuel Morehouse, of Eastport, Maine, June 19.

In the engine for dividing scales, gauges, rules, &c.; Samuel Hedge, of Windsor, Vermont, June 20.

In suspenders; Edwin Chesterman, of New York, June 19.

In the grist mill, for grinding grain of any kind; William A. Turner, of Plymouth, Washington County, N. C., June 27.

In the machine for dicing, and polishing, or rolling morocco leather; Samuel Couillard, jr., of Boston, Massachusetts, June 27.

In the machine for sawing shingles out of planks, &c.; Nathan Swift, of Lebanon, Conn., June 27.

In the washing machine; David Beard, of Buffaloe, New York, June 27.

In the plough; William Beach, of Philadelphia, June 27.

In the machine for hewing and hammering stone; Charles B. Reed, of West Bridgewater, Plymouth County, Massachusetts, June 27.

In the machine for spinning wool; Benjamin Lapham, of Queensburg, Warren County, New York, June 29.

Improvement in the horse harness, called a horse yoke; Adolphus Allen, of Troy, New York, June 29.

In preventing friction on spindles, called serve wheels; Johann Gottleib Sholze, Pickaway Township, Ohio, July 6.

In the percussion gun-lock; Marvel C. Davis, of Mayville, Chataugue County, New York, July 10.

In a mortising machine; Simon Leroy, of Mexico, Union Square, Oswego County, New York, July 10.

In manufacturing steam and rotary wheel engines; Francis Harris, of Albany, New York, July 10.

In the mode of manufacturing wool or other fibrous material; John Goulding, of Dedham, Norfolk County, Massachusetts, July 10.

In the machine for roping and spinning wool and cotton by hand, called "Brown's vertical spinner;" Henry Wilson, of Pomfret, Chataugue County, New York, July 13.

In the means of transporting a boat, or other body, from one canal level to another; Robert P. Bell, of New York, July 13.

In cements for roofs, or walls of buildings, &c.; Charles Clinton, of New York, July 13.

In the screw auger; Judson Smith, of Derby, New Haven County, Conn., July 13.

In the hand printing press; Samuel Couillard, of Boston, July 14.

In the machine for bending tire of carriage and other wheels, me-

tallic bands, and hoops, &c.; Walter James, of Ashford, Windham County, Conn., July 14.

Improvement called Cooper's rotative piston; John M. Cooper, of Guildhall, Essex County, Vermont, July 16.

In the mode of conveying or hauling earth, stone or other substances, from the bottom of canals, or other cuttings in the earth, by machinery; Oliver Philips, of Lansing, Tompkins County, New York, July 16.

In the grist mill; Washington Adams, Guilford County, N. C., July 18.

In fermenting and distilling spirits; Ira Belnap, Millersburg, Dauphin County, Pennsylvania, July 20.

In the manufacture of gas-lights from cotton seed; Denison Olmsted, New Haven, Conn., July 21.

In the portable crane, for raising brick, stone, mortar, timber goods, &c. Ezekiel Mann, and George Hill, of Rochester, Monroe County, New York, July 21.

In the grist mill; Avery Coe, and John Coe, of Guilford County, N. C., July 21.

In the bush for a mill-stone; Nathan Taylor, Urbana, Steuben County, New York, July 23.

In the mode of making cordage, by machinery; Robert Graves, Brooklyn, New York, July 25.

In the mode of passing canal boats, up and down elevations, by machinery; Robert Graves, Brooklyn, New York, July 26.

In the machine for making Cooper's staves, ready for the tress-hoop; Amory Amsden, Bloomfield, Ontario County, New York, July 27.

In the machine for spinning wool and cotton, called the family spinner; William W. Jones, Thornville, Perry County, Ohio, July 27.

In the construction of rail-way carriages; Richard P. Morgan, Stockbridge, Massachusetts, July 27.

In the machine for cutting straw; Laban Durham, and John S. Pleasants, of Halifax County, Virginia, July 27.

In the machine for cutting wheat, oats, &c. by horse power; Laban Durham, and John S. Pleasants, of Halifax County, Virginia, July 28.

In a machine called an up and down revolving water wheel, for raising water; Henry Miller, of Allentown, Northampton, Pennsylvania, July 28.

In the cast-iron horse hoe, for ploughing and weeding grains and herbs, planted in hills, and rows; William Carmichael, Land Lake, Renssalaer County, New York, July 28.

In the machine for warning, or notifying the drivers of carriages, called the coach alarm; Walter Hunt, of New York, July 30.

In the manufacture of hollow wooden ware; Elisha Briggs, of Perry, Gennessee County, New York, July 30.

In the method of cooling water, or other fluids, William Thornton, of Washington City, D. C., July 31.

In a machine called Schreiner's chimney smoke, and safety valve; Joseph H. Schreiner, of Philadelphia, Pennsylvania, July 31.

In the mode of moving brick, stone, or wooden buildings, with the chimneys, furniture, and families therein; Simeon Brown, of New York, July 31.

In the harrow and plough hoe, or a new method of attaching hoes of different descriptions, to the helve of the harrow and plough, for cultivating corn, wheat, rye, oats, cotton, tobacco, &c.; Isham Cheatham, of Providence, Chesterfield County, Virginia, July 31.

In the machine for cutting card teeth; Joshua Lamb, of Leicester, Massachusetts, August 1.

In the tide mill; Robert Spedden, of Talbot County, Md., August 1.

In the machine for dressing, drilling, and working granite, and other kinds of stone; Hermon Bourne, of Salem, Essex County, Massachusetts, August 3.

In a machine called the sack shoulderer; Lewis Rice, of Clarksboro, Gloucester County, New Jersey, August 3.

In the machine called the economical victualler, being an improvement on the peripurist; Benjamin C. Burdett, of New York, August 4.

In the mode of tightening bed sackings, called the improved detached screw bed sacking; John K. Simpson, Boston, Massachusetts, August 10.

In the machine for separating the seed from cotton, called the Sea Island cotton cleanser; Jesse Reed, of Marshfield, Plymouth County, Massachusetts, August 10.

In the thrashing, winnowing, and flax breaking machine; Edmund Warren, New York, August 10.

In a machine for removing stumps, and other heavy and fixed bodies; Abijah Pratt, of Jackson, Washington County, New York, August 17.

In the steam engine; Warren P. Wing, of Greenwich Village, Hampshire County, Massachusetts, August 17.

In the machine for separating, or thrashing grain from the straw, and for breaking flax, and hemp; Peter Barker, of Worthington, Franklin, Ohio, August 20.

In the plough, called the right and left plough; George Dofler, Fredericktown, Md., August 20.

In the method of determining the proof and strength of distilled, or alcoholic spirit; William Cornell, Brooklyn, New York, August 20.

In the water wheel, for saw and grist mills; James Deniston, of Lanier Township, Preble County, Ohio, August 22.

In the construction of a sofa and bedstead united, which may be used for either purpose; John R. Penniman, Boston, Massachusetts, August 22.

In the gearing of cones, for bowing hats; Trueman F. Mayhew, Boston, Massachusetts, August 22.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from July 25th, to September 6th, 1827.

To Edward Dodd, musical instrument maker, for his invention of certain improvements on piano-fortes—25th July.

To Thomas Peck, engineer, for his invention of the construction of a new engine, worked by steam, which he intends to denominate a revolving steam engine—1st August.

To William Parkinson, gentleman, and Samuel Crosley, gas apparatus manufacturer, for their having found out an improved method of constructing and working an engine, for producing power and motion—1st August.

To Joseph Maudsley, engineer, for his invention of certain improvements on steam engines—1st August.

To Lionel Lukin, esq., in consequence of communications made to him by foreigners abroad, and discoveries made by himself, for certain improvements in the manufacture of collars, for draught and carriage horses, and saddles, for draught, carriage, and saddle horses —1st August.

To Eugine du Mesnil, esq., for his invention of an improvement, or improvements on, or additions to, stringed musical instruments—1st August.

To Anthony Scott, earthenware manufacturer, for his invention of an apparatus, for preventing the boilers of steam engines, and other similar vessels of capacity becoming foul, and for cleaning such vessels, when they become foul—4th August.

To Peter Burt, mathematical instrument maker, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of an improved steam engine—4th August.

To John Underhill, for his invention of certain improvements in machinery, or apparatus for passing boats and other floating bodies, from a higher to a lower, or a lower to a higher level, with little or no loss of water, and which improvements are also applicable to the raising or lowering of weights on land—13th August.

To Robert Dickinson, tin plate merchant, for his invention of an improved buoyant bed or mattrass—13th August.

To Thomas Breidenback, merchant, for his invention of certain improvements on bedsteads, and in making, manufacturing, or forming articles, to be applied to, or used in various ways with bedsteads, from a material, or materials, hitherto unused for such purposes—13th August.

To William Alexis Jarrin, Italian confectioner, for his invention of certain improvements in apparatus for cooling liquids—13th August.

To William Chapman, civil engineer, for his invention of a certain improvement or improvements, in the construction of wagons that have to travel on rail-ways or tram-ways—14th August.

To Henry Pinkus, of Philadelphia, in the state of Pennsylvania,

in the United States of North America, but now resident at the Quadrant Hotel, Regent street, in the county of Middlesex, gentleman, for his having invented, or found out, an improved method or apparatus for generating gas, to be applied to lights and other purposes—15th August.

To William Spong, gentleman, for an invention for diminishing friction in wheel carriages, water wheels, and other rotatory parts of machinery—15th August.

To Lemuel Wellman Wright, engineer, for his having invented or found out, certain improvements in the construction of cranes—17th August.

To Lemuel Wellman Wright, engineer, for his having invented or found out, certain improvements in machinery for cutting tobacco—21st August.

To Gabriel de Soras, gentleman; and Stacey Wise, and Charles Wise, paper-makers, in consequence of a communication made to them by a certain foreigner resident abroad, for an invention of certain improvements in sizing, glazing, or beautifying, the materials employed in the manufacturing of paper, pasteboard, Bristol boards, and other substances—21st August.

To John Hague, engineer, for his invention of a new method of working cranes, or tilt hammers—30th August.

To Benjamin Merriman Combs, ironmonger, for his invention of certain improvements, or additions to a pulley machinery, and apparatus, used and applied for securing, fixing, and moving, curtains, and roller, and other blinds—30th August.

To William Debtmer, piano-forte maker, for his invention of certain improvements on piano-fortes—30th August.

To William John Ford, farrier, for his invention of certain improvements in the make, use, and application, of bridle bits—6th September.

To George Clymer, engineer, for his invention of an improvement in typographic printing, between plain or flat surfaces—6th September.

FRENCH PATENTS.

List of Patents granted by the French Government, from the first of April, to the 30th of June, 1827.

To Messrs. Barthelemi Galimer, Son, of Cannes, distiller, and Michel Espinas, of Beziers, coffee house keeper, for a moveable apparatus for distilling wines, and other liquors—10 years.

Messrs. Dollfus, Mieg and Co., of Mulhausen, oil cloth manufacturers, for a machine for printing several colours and shades upon stuffs at the same time—5 years.

Louis Joseph Pouiltot, and Daughter, pewter manufacturers, of Paris, for a pencil case with ink-horn, brass pens, and sand box—5 years.

M. Ancelle, shoemaker, Paris, for an elastic clog—5 years.

Messrs. de Renneville, and Lemoine Desmares, for a new method of bleaching and washing wool—10 years.

Jean Louis Boucarut, painter and gilder, Paris, for improvements in pannel painting—10 years.

Messrs. Koechlin, and Zimmermann, builders, of Kaisersberg, for a stretching board for cotton spinning—5 years.

Messrs. Favreau, Paris, for an instrument which may be used as a pencil case and inkstand, by means of a small forcing pump—5 years.

M. Havard, pump manufacturer, Paris, for an apparatus adapted to the seats of water closets—10 years.

Louis Roth, Paris, for a new method of distilling, with other improvements—10 years.

Zavier Andoyer, writing master, Paris, for the invention of a new system of writing, called the American, or the art of learning to write in a few lessons—5 years.

Mathurim Cosson, billiard table maker, for new invented pockets for billiard tables—5 years.

Messrs. Alexis Orry, Honore Nery, and Claude Simon de Cormeille, engineers, Paris, for an apparatus, called a fumi-comburateur, for consuming smoke and its noxious particles—10 years.

Jean Baptiste Thomas Jamain, of Charleville, tinman, for a pump with four valves, for raising water from the deepest well to the upper stories of houses—5 years.

Joseph Claude Heyraud, Paris, for a method of making horse shoes with a die—10 years.

Louis Joseph Etienne Cordier, Paris, for improvements in floodgates and sluices—10 years.

Francois Pierre Lebourlier, Paris, for a method of stripping the rind, and whitening black pepper—5 years.

Isaac Sargent, and Thomas Hodgkin, Paris, for improvements in baking bricks, tiles, slabs, and earthenware—15 years.

Armand Lemonnier, mechanic, Chatillon sur Seine, and Joseph Maitre, of Villotte, for a machine for making the tires of wheels—10 years.

Jean Pierre Caplain, mechanic, and Deve Lemaitre, of Elbeuf, for a machine for making pins' heads in general—5 years.

Edward Church, American Consul, at Lorent, for a gandole to sail by steam—5 years.

Jacques Francois Etienne Onarmier, Paris, for a high pressure filtering stone—10 years.

M. Guelle, tinman, Paris, for improvements in making sky-lights, window frames and glazing, called the finestra—5 years.

M. Hulot, calico maker, St. Arnould, for a stuff for making collars and stocks—5 years.

Louis Ladaviere, Jeweller, Lyons, for a machine called semequelle, for marking the points at cards and other games—10 years.

Moisson Devaux, Paris, Banker, for an apparatus for making metallic tubes by pressure—10 years.

Stanislas Sorel, of Ecouche, and Louis Francois Prudent Artus, of Alencon, clockmaker; for a pyrometre, for measuring the higher temperatures—5 years.

M. Bantam, jeweller, of Paris, for a double pair of spectacles called the binocle a tirage simultanee—5 years.

Hilaire Bellomet Warin, ironmonger, of Remilly, for improvements in spindles, &c.—5 years.

Dr. Allevy, Paris, for a machine called the hydro ponderique, for raising weights—15 years.

Charles Frederick Gagnoux and Co. silk manufacturers, Lyons, for a loom for making net work with square meshes—15 years.

Parfait Modeste Carpentier, Paris, for a mechanical bed, and arm chair, with springs, for the use of sick people—15 years.

Henry Pottet Delcusse, gunsmith, Paris, for a gun which may be loaded by the stock or breech—5 years.

Theodore Jones, London, for improvements in the wheels of carriages, &c.—15 years.

Pierre Fasanini, Lyons, for a machine for weaving, so constructed that when the woof or warp breaks, the machine stops—10 years.

Louis Bassnet, perfumer, Bordeaux, for a powder and lotion, for preserving the teeth and mouth, called the poudre and liqueur vegetales—5 years.

Jean Baptiste Fournier, Paris, for improvements in the pockets of billiard tables—5 years.

Pierre Victor Becasse, Paris, for improvements in the spokes of wheels—5 years.

[TO BE CONTINUED.]

NOTICES.

To Correspondents.—The completion of the article on extracting the Fecula from the Potato, is delayed in consequence of the unfinished state of the engravings.

Kiln for drying Indian Corn.—A subscriber will be obliged, by information on an economical mode of constructing a kiln, for the above purpose. We intend to prepare an article on this subject, and hope that some person who has had experience, will enable us to give to it all the practical value of which it is susceptible.

Errata.—In consequence of changing a word, without making a corresponding change in the other members of the sentence, a small part of the impression of the present number, requires the following corrections:

Page 90, line 7th from the bottom, for '*it professes,*' read, they profess.
Do. „ 6th „ „ for '*supposing it,*' read, supposing them.